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## THE OHIO ELECTRIC LIGHT ASSOCIATION CONVENTION.

It is a striking illustration of the strength of the electric lighting and motor-service industry that a single state association can call together over 350 persons at its annual convention, as was the case at Cedar Point, Ohio, last week at the Ohio Electric Light Association convention. Not many years ago the attendance at a National Electric Light convention did not exceed this figure. While some might fear that the great activity displayed by the National Electric Light Association and the rapid increase of membership in it might detract somewhat from the state associations, quite the contrary appears to be the case. In fact, there has been a notable increase in strength of the state associations along with the recent rapid growth of the national association. What all this really means is that the central-station industry is waking up to its strength and importance, and to the possibilities of the business. Central stations in their various territories are performing the large variety of services for their communities, which we have for many years maintained they should perform. There was a marked tendency this year in the Ohio association to send a large number of men from one company, just as was the case in the recent National convention. For example, at the Ohio convention all of the directors of one company operating in a town of about 8000 inhabitants were present, and the total delegation of the company was six men. The directors were not technical men, but were prevailed upon by the president of the company to attend this convention in order to place themselves in a position to act more intelligently upon matters which are coming up for them to decide. Many other companies also sent a number of men instead of a single representative, as was the custom in former years.

This year the discussions and papers were entirely on subjects of practical importance in operation and management, instead of extended descriptions of new apparatus, which have sometimes taken large places on the Ohio program. The subjects were so distributed, and the discussions likewise, that no one feature could be said to stand out prominently. Probably more discussion was given to the subject of rates than to any other one question, as the recent announcement of the manufacturers that tungsten lamps in small sizes which are not fragile will soon be regularly on the market has set many managers to thinking as to what changes in the rate schedule can be made to enable them to handle residence business at a profit with a reduced kw-hour consumption. The question of making a motor-service rate which will be acceptable to owners of isolated power plants and at the same time profitable to the central station, is also more live than ever. The results reported from tungsten lamps in street lighting service may be considered as highly encouraging. Not only is the life of the lamps remarkably long, but the candle-power is well maintained throughout the whole life, which performance is in striking contrast to the rapid deterioration of certain of the rival illuminants.

## OUTDOOR BUSBARS.

As recently noted in detail in these columns, the 100,000-volt busbars of the Denver substation of the Central Colorado Company are all out doors, except for very short distances where they pass directly from insulated roof bushings to transformers in the substation building proper. The 100,000-volt oil switches are each in a separate switch house just large enough for one three-phase switch, and the lightning arresters are also in a separate building by themselves. The cost of the entire substation, considering the relative amount of investment involved, is probably lower than for a substation enclosing the 100,000-volt bus bars which would afford equal security from damage by arcs between busbars. The higher the voltage, the more difficult becomes the problem of properly housing and enclosing bus bars of such high potential. For 100,000-volt lines the best insulating barrier is plenty of air space out doors, for while this may be temporarily broken down, it is at least self-healing and does not require expensive repairs after an arc between conductors. Outdoors the necessary safe space between conductors is cheaply obtained in such locations as are likely to be selected for 100,000-volt substations. To enclose and protect properly in one building the amount of 100,000-volt wiring that exists around the Denver substation, and to make it as safe as it is now, would require a building of formidable proportions. Of course, the climatic conditions in this case are extremely favorable for the dispositions adopted. The tripping coils perform their work through the medium of long insulating rods which connect them mechanically with the low-voltage switch control circuits.

## THE COMPOUNDING OF ALTERNATORS.

Among the numerous methods used for compounding alternating-current generators a most prominent one is that involving the use of a rectifier through which passes the load current either directly or indirectly, and which furnishes unidirectional current for a "series" winding on the field poles of the alternator. A modification of this method consists in placing the "series" winding on the field poles of the direct-current generator supplying excitation for the alternator. In either event the degree of compounding depends upon the value of the load current and is affected only slightly by any change in the power-factor of the load. A large change in the power-factor usually means much sparking at the rectifier and a decrease in the compounding effect. An arrangement in which use is made of certain of the features of the above-described method, but which omits the rectifier and obtains a compounding effect varying largely with the power-factor of the load, is described in an article by Prof. Andre Blondel, abstracted in the Digest in this issue.

In an alternating-current generator, the armature m.m.f. depends solely upon the value of the armature current, but the effect upon the voltage regulation varies largely with the power-factor. When the power-factor is unity the mean armature m.m.f. is in a direction to distort the field magnetism, but not to alter its value. If the power-factor could be reduced to zero the distortion would cease, but the armature m.m.f. would either directly assist or oppose the field-circuit m.m.f. according to whether the wattless current were "leading" or "lagging." At intermediate power-factors the opposition to the field-circuit m.m.f. varies directly with the value of the lagging component of the armature current. It will be seen, therefore, that so far as concerns the change in the field magnetism of the alternators, perfect "compounding" could be obtained by a method which allowed the field circuit m.m.f. to vary directly with the lagging component of the armature current.

In the Blondel arrangement the load current from the armature winding of the alternator is passed, without rectification, through a special "series" winding on the rotor (armature) of the direct-current exciter of the alternator. This special winding revolves synchronously with the alternator, and the current therein is so directed that its lagging component assists the field-circuit m.m.f. of the exciter, which is itself a separately excited machine. Thus, the greater the value of the lagging component of the load current on the alternating-current generator, the greater is the assistance rendered in magnetizing the field cores of the exciter, the greater is the exciting current supplied to the alternator and the higher is the internal generated e.m.f. of this machine. For the Blondel arrangement there are claimed absence of delicate mechanism and ease of adjustment of both the no-load voltage and the degree of compounding. When once the adjustments have been made the operation is strictly automatic and depends solely upon electric and magnetic reactions.

## THE RATING OF LAMPS IN STREET LIGHTING SERVICE.

The ever-present subject of the proper method for rating lamps used in the lighting of streets was brought into some prominence at the recent convention of the Ohio Electric Light Association. In the discussion of one of the papers mention was made of the fact that certain gasoline lamps bearing a rating of 60 cp actually varied in output from a maximum of a little below 60 cp to a minimum of perhaps 20 cp. The existence of such a discrepancy between actual output and the rating of the lamps should not be considered as indicating an attempt on the part of the lighting company to deceive the people paying for the lighting service; it shows merely that there is no definite relation between the rating and the output, the former being an arbitrary designation of the lamp. That is to say, even though the lamps had been rated at 100 cp. the company cannot be accused of an attempt at deception, provided only that those paying for the service were aware of the exact lamp to be used and knew from previous observations what results to expect. However, the arbitrary designation of lamps in candle-power is apt to work hardship when two types of lamps rated according to different arbitrary methods are to be compared, since the candle-power basis is the one most likely to be selected for this purpose. For example, it is manifestly unfair to compare the cost of operating 60-cp electric lamps with 60-cp gasoline lamps, when each is rated in arbitrary units having no direct relation to the candle-power obtained.

The discrepancy noted above is not confined to incandescent mantle lamps, but exists with certain types of electric lamps, especially those formerly in common use for street lighting. When electric street lamps were rated at 2000 cp or 1200 cp no harm resulted from the fact that the lamps did not deliver candle-power according to their ratings, because it was recognized that the ratings referred merely to certain well-known

types of lamps. However, with the introduction of improved lamps for street-lighting service which were more conservatively rated, confusion was brought about and the more recent types of lamps frequently suffered in the comparisons that were made with the earlier types.

Just what plan should be adopted for rating street lamps of various types only extended experience can determine. There can be no doubt, however, that a rating based on the initial maximum candle-power in a single direction under the best laboratory conditions is not a fair one to apply to a type of lamp which deteriorates rapidly in service and has a wide range of candle-power in different directions in the vertical plane. The best criterion is the service rendered, and possibly a rating based on the average service obtained will prove the most satisfactory in the end. In any event, it is highly undesirable to refer to a lamp having a mean spherical candle-power in service of, say, 30 cp as a 60-cp lamp, or to designate as 1200 cp a lamp giving perhaps less than half that value in spherical candle-power.

## THE QUARTZ MERCURY ARC IN STREET LIGHTING.

We note from our foreign contemporaries the introduction of quartz mercury arcs into the street-lighting system of Paris. The units, a description of which appeared in our issue of March 17, employed are of 1000 cp and 2000 cp in fairly dense diffusing globes. The results are stated to be very satisfactory, the intrinsic brilliancy being so reduced to give a soft and pleasing effect even with the great intensity of the lights, and the life of the tubes being about 2000 hours. The quartz lamp has made no impression as yet in this country, owing chiefly to the fact that until quite recently the world's whole output has been the product of a single factory in Germany, and it is quite obvious that no large commercial use of quartz lamps over seas from this source would be feasible, particularly as the tubes have a most evil reputation for fragility. Of late, however, several manufacturers have taken up the work of producing the tubes, itself a task of no small technical difficulty, and it is not unlikely that before long we may have an adequate source of supply in this country. Given this, the quartz lamp would have to be taken very seriously as a possible street illuminant. Its economy is approximately that of a first-class flame arc, say, from ¼ watt to ⅛ watt per candle. The color is sufficiently good for street work, and the steadiness considerably better than that of any other very powerful illuminant. Beside this, there is the great advantage of having a lamp running practically without attention and requiring replacement of active material only two or three times a year. An additional advantage which might be turned to very great account is the fact that the source being a fixed tube only a few inches long and perhaps ¼ in. or so in diameter can be very readily adapted to shades or to prismatic reflectors which would give almost any type of distribution desired for efficient street service.

Against these advantages stands an element of danger from the very powerful ultra-violet radiation produced by the quartz lamps, which is well known to be dangerous to the eye. Just how dangerous it is and how easily the danger can be eliminated is not yet well known; but the lamps of one of the chief German makers are sent out with a name plate bearing a specific warning against the employment of the lamp without a glass outer globe. How far this globe is actually efficient in cutting off the ultra-violet rays is not definitely known, but it undoubtedly cuts them off to a considerable extent, and it is not impossible that the absorption of some of the damaging radiations by the air itself may be sufficient to render the light harmless in case of a broken globe, if suspended at a suitable height for street lighting. The tube is so small that automatic lighting should be a very easy matter, and a lamp of very high efficiency requiring no trimming and but infrequent renewals would certainly prove a great boon to the central-station man, who now is between the devil and the deep sea, when it comes to first-class arc lighting, with inefficient enclosed arcs on the one side and expensive trimming for flame arcs on the other. Even the magnetite lamp, excellent as it is in many respects, is far less efficient and requires much more care than these quartz lamps are reputed to do. We hope somebody will shortly undertake the manufacture of tubes in this country so that central-station operators may have a fair chance to experiment with them both for street and commercial work, although for the latter they possess less advantages than for the former, in view of the progress that has been made in incandescent lamps. The situation is a most interesting one, and we shall await with a great deal of interest further reports from the Paris installation as to the practical working of the system on something more than a casual and experimental scale. Meanwhile the element of danger well recognized with respect to the quartz lamp ought to be thoroughly investigated to determine its real magnitude and significance.

## THE MANUFACTURE OF ICE BY CENTRAL STATIONS.

The economies and profits incident to the operation of a combination electric and steam-heating station are quite generally known, for the subject has been freely discussed before national and state bodies and in the technical press. Although their total number is almost twice as great, combination electric and ice-making plants have not been taken so seriously in the North; however, in the South, where natural ice is not a competitor of the manufactured product, they are in general use. As manufactured ice is coming into greater and greater use for hygienic reasons, due to the pollution of fresh water streams by sewage and the refuse of manufacturing establishments located on their banks, the question of combination electric and ice-making stations becomes one of much importance to the central-station industry. Already the country abounds with independent ice-making establishments, which, even as they are, offer profitable and legitimate off-peak central-station loads. Unfortunately, few central-station companies have succeeded in acquiring such loads. The rates may be too high or there may be other reasons for not driving the compressors by electric motors just at present. Sooner or later, however, the steam-driven compressors will be supplanted by electrically driven machines, because the load is of a kind to appeal to progressive central-station managers who can thereby best dispose of surplus electrical energy and obtain a load factor for their stations sufficiently high to justify any concession made in acquiring it.

An electric light station, however small, can create a market for its surplus energy at its own door by the installation of ice-making machinery. Unlike a steam-heating load, ice making

does not require extensive underground work and is absolutely under the control of the station at all times. According to the conditions of the electric light load, much or little ice can be manufactured and during dull lighting seasons or at times of light load, the ice-making plant can be operated at its maximum output and the ice placed in storage against the day of its use. These are mere details of operation and have nothing to do with the greater problem. There are certain precautions to be taken at the outset, however, and in erecting an ice-making plant it is well to use the experience of others as a guide. Many who have gone into the ice-making business have been carried away by enthusiasm over brilliant possibilities only to learn that all that glitters is not gold. Those who have been successful have studiously avoided the will-o'-the-wisps of exuberant expectancy. Realizing that the market is limited to a certain season, they wisely provided for abundant storage, installing a medium-size plant in preference to one capable of meeting the maximum one-day demand for ice. This plan enabled the plant to be operated continuously and obviated all of the disadvantages of intermittent use. The employment of steam-driven apparatus in preference to motor-driven apparatus may be attributed to the attitude of the manufacturers of ice-making machinery. To them is usually left the selection of the entire ice-making installation and, being rooted and grounded in steam practice, the employment of electricity seems an innovation. The trouble is that there are very few power-plant engineers conversant with refrigerating engineering. The two subjects are bound to come into closer and closer relationship so that power-plant engineers should become familiar with the outlook from a refrigerating viewpoint.

Two efficient refrigerating processes are in use at the present time; the compression process and the absorption process. Both produce refrigeration by the boiling of ammonia. In the former, use is made of a compressor and a water cooler to produce the liquid ammonia; while with the latter, the absorptive power of water for ammonia gas and the loss of this quality with rise in temperature are employed to produce the same result. The latter is the older system, but the former is more widely employed at present. It is claimed, moreover, to be higher in efficiency for small units, while in larger units the absorption system is superior to it. The efficiency of both types of machinery depends largely on the intensity of refrigeration, the compressor machine losing rapidly with a diminution in the temperature required, whereas the efficiency of the absorption machine remains practically constant. The ability of the latter type of apparatus to use exhaust steam is one of its most important features. The compressor plant lends itself readily to motor operation, hence its popularity. Even where the compressor is steam driven certain economies are obtained. The logical method of operating compression plants, however, is to drive the compressors by electric motors and to utilize the exhaust steam from the engines for the necessary distilled water employed in making ice. Both of these the central station possesses, and this fact should be impressed on the manufacturers of ice-making machinery. Small stations only partially loaded can thus install motors, which in an alternating-current station would improve the load factor, better the efficiency of the plant as a whole, and use all of the exhaust steam available. With the absorption process, a fair-sized ice plant can be operated from the exhaust steam of the station, which would otherwise go to waste.

## THE MAKING OF RATES.

The fundamental purpose of a system of charging for electrical energy is to secure the maximum net profit from the plant concerned. One may theorize all he pleases regarding the matter and in the last resort it comes straight back to this simple principle. Electric supply companies are not in business for their health, and while most company managers in these days have a wholesome feeling of responsibility to the community they serve as a public corporation, it is their business in the interest of their stockholders to secure such profit as may be from the administration of the property. Experience has taught that certain very moderate limits of price cannot be exceeded without cutting the net profits, and it is a fact that electrical energy is almost the only important commodity the price of which to the public has been constantly lowered throughout a time of exceptionally rapid rise in general prices. We have yet to hear of any central-station manager who has followed the example of some of the electric railway companies by going around and moaning to the authorities concerning the increased cost of material and labor, basing thereupon a long-drawn plaint, the burden of which is that he should be allowed to raise his prices to the people. With a full realization that their product should be made a necessity and not a luxury, the central-station men have kept their prices for electrical energy on the downward grade and thereby very generally have increased the net profits.

The above has been given by way of preliminary to the interesting question of the method of charging for electrical energy which shall be applied in any given community. Inasmuch as public regulation and sound business policy unite on fixing an upper limit of price beyond which it is not safe to go, the principal function of any particular system of charging is to get business, all the business that the community can fairly yield, in such wise as to increase the earnings of the supply company. We are presenting in the current issue one of the many attempts to solve the rate problem upon the basis of the fixed and variable charges involved in the operation of the plant for the service of its customers. On the hypothesis explicitly or implicitly introduced the solution arrived at by Mr. Marks is a correct deduction from the premises. But what we wish to point out here is not the particular segregation of items of fixed and service costs from which a particular conventional system of rates may be derived, but rather some of the fundamental principles upon which all rate systems for electrical energy must depend if they are to fulfill the function heretofore stated.

A central-station manager knows, or should know, very accurately the gross cost in fixed and variable charges of the product delivered in any given year or month. If he can secure a certain net profit from sales after these expenses are paid it could almost be said that he is not interested in the exact sort of schedule on which the sales are made, always provided that it is a schedule which will help him get more and more profitable business. The central-station man deals with the aggregate. The consumer, who deals with the items which make up the aggregate, on the other hand, is keenly interested in getting his service at the lowest possible price, but is perturbed in spirit only when the aggregate seems unwarrantably high, or when he knows or fancies that he is paying a higher price than his neighbors.

The two conditions that have to be filled by any system of charging are increase of business, and hence of profit for the station, and decrease of complaints among the consumers. The various rate systems which have been advocated are various imperfect attempts to meet these two conditions. There is no such thing as a judicial or scientific method of charging which is even approximately justified by the facts. Explicitly, or implicitly, all the rate systems, except the flat rate, involve the averaging of certain factors and conditions which apply differently to the cases of different consumers, and from the standpoint of punctilious precision affect some consumers favorably and others adversely. To begin with, why should one take a yearly average of cost, either fixed or variable, as the criterion of constructing a charging system? It is more logical, more scientific and more precise to take a quarter, or a month, or a week, or some other short interval of time as this criterion. The shorter periods are not taken simply because they are not convenient and because it seems wiser to run the chance of inequitable distribution of charges than to go to the trouble of a higher degree of precision. In point of fact the average cost of a kw-hour delivered is a continuous variable over a range in most stations almost or quite as wide as the range of retail prices. Why should not a consumer who uses energy only during the winter get the benefit of the better load factor during that period, and why, on the other hand, if one is a stickler for precision, should not a consumer who wants off-the-peak energy at a time when the daily cost of output runs high, pay more for it than if he desired energy during hours when the books would necessarily show that the cost of production is less, if the books are strictly kept?

Here is the logical flaw in all so-called scientific systems of rates that are based on implicitly averaging wide variables. It is a perfectly justifiable process from a commercial standpoint, and from a commercial standpoint it is as sound to average one set of variables as another. One of the common rate systems, of which Mr. Marks' is a type, consists in dividing the stand-by charges in proportion to the amount of the public service demanded by the patron and then fixing the quantity price by reference to some more or less formal segregation of the variable charges. It is a process superficially sensible enough, but it has no claim to absolute equity or scientific precision. It is simply an arbitrary division of costs in which certain factors are taken by general average. It is a little difficult to define the amount of the public service demanded by a patron and, by various rate makers it has been taken as proportional to the connected load, to the maximum demand for a particular part of the year, or for each month separately, to the area of the building served, and to various other things which have seemed for the particular purposes to be convenient. The practical demand of a given consumer for the setting apart of part of the plant for his use depends on a great number of factors, most of which have from time to time been recognized in rate making, although the aggregate of all of them is too intricate to serve as a basis of a schedule which would be reasonably comprehensible and reasonably easy to carry through the bookkeeping department; hence the very loose but entirely justifiable procedure of averaging such factors as seem for the place and conditions convenient.

It is well known, for instance, that in residence lighting the practical reservation of equipment demanded is very much less than in the case of lighting small shops, and, moreover, comes at a totally different time. A theater, on the other hand, demands a considerable reservation of equipment in theory, but in practice calls for it at a time when the reservation does not generally mean increase of plant equipment or of relative operating costs. Again, a system rigorously worked out on any pure demand basis gives absolutely no excuse for discrimination between motor and lighting loads, assuming them to be distributed over the same system, and yet as a matter of fact it is found commercially necessary in many places to make this discrimination for the sake of fulfilling the first function of every charging system—that is, of getting profitable business.

The maximum demand system is an equally futile attempt at an equitable basis in the sense of scientific accuracy, although it has proved convenient and useful, like many another system, in certain cases. Practically the equipment reserved for a given customer depends not only on his maximum call for energy, but on its duration and frequency and on the time at which it occurs. It hence is a matter of common knowledge that certain classes of customers, notably residences, are severely punished by that particular method of averaging the stand-by charges. The diversity factor, in short, instead of being a small and inconsequential matter, is a very large and important one. From the standpoint of precision even a contract system at so much per lamp per month in certain classes of service is just as justifiable and just as precise as any of the others. It is merely again a question of averaging the conditions. It has been found in certain cases that one can, on the basis of the equipment installed, average the demand and the energy used at one stroke. In fact, one could, by taking a sufficient number of consumers and studying their conditions of service, devise schedules that would be substantially as effective and fair as any others, while basing them on things as diverse as the dimensions of show windows or the annual contribution of each customer to the poor box.

It is not the purpose of these remarks to decry the efforts of Mr. Marks in studying the subject of rates, but merely to point out that any attempt to evaluate rates which depend on averaging quantities which themselves vary widely is bound to produce discriminations which in many individual instances work badly. And after all, to recur to the statement with which this comment opens, the purpose of rates is to get business, and it is found in practice that in order to get that large volume of business which tends to increase production and hence to decrease costs it is necessary first or last to sell to the consumer at a price which makes the proposition of electrical service attractive to him. At a price, for example, which makes it inexpedient to operate isolated plants for lighting or gas engines for motor service. In other words, rate making in the last resort is a matter of policy, as Mr. Marks himself suggests in presenting three sliding scales derived from three different segregations of the cost, and proposing an arbitrary average price for certain classes of consumers. It is always necessary to know the cost of producing output, but the price at which it is distributed is a matter in which the best financial results are obtained only by studying the needs of the consumers.

## Convention of the Pennsylvania Electric Association.

The convention of the Pennsylvania Electric Association, State branch of the N. E. L. A., to be held at Glen Summit Springs Hotel, Glen Summit Springs, Pa., Sept. 14, 15 and 16, will be made as attractive as possible from every point of view. The location, 2500 ft. above sea level, is on the main line of the Lehigh Valley Railroad. The entertainment committee is arranging a program to make the convention pleasing to the ladies and to provide amusement for all. Opportunities are provided for boating, bathing, baseball, tennis, bowling, etc.

The program committee is arranging for the preparation of the following papers: *Steam Heating, Advantageous Points in Station Operation, New Types of Lamps from the Operating Standpoint, Operation of Electrical Vehicles, Domestic Appliances, Investment Justified by Smaller Companies for Securing Motor Load, Rates.* These papers are being written from a practical standpoint and will be arranged so that members who find it inconvenient to attend all of the sessions may be able to select one day to advantage. The discussion will be made a prominent feature of the meeting.

## Association of Railway Electrical Engineers.

The date of the annual convention of the Association of Railway Electrical Engineers, to be held in the Hotel La Salle, Chicago, has been changed. The convention will be held on Sept. 27-30 next, instead of a week later, as originally planned. The organization has about 400 members, and a well-attended and useful convention is anticipated. Mr. E. M. Cutting, of the Southern Pacific Railroad, Oakland, Cal., is president of the association, and Mr. George B. Colegrove, of the Illinois Central, Chicago, is secretary. This association is the successor of the Association of Car Lighting Engineers, but it has outgrown the original restricted scope indicated by that title, and is now a flourishing organization of steam-railroad men interested in electrical problems, with a wide field and an earnest purpose. Electricity is used for so many things by the steam railroads, as the operation of shop motors, car lighting, signaling systems, and the like, that the association has ample opportunity for usefulness.

A feature of the coming convention will be an extensive exhibit of electrical appliances. The Railway Electric Supply Manufacturers' Association is an affiliated organization, formed to further the interests of the manufacturers who have business relations with members of the Association of Railway Electrical Engineers. The association of manufacturers and supply men will have charge of the exhibit at the coming convention. The president of the Manufacturers' Association is Mr. W. L. Bliss, of the United States Light & Heating Company, of Milwaukee, while Mr. J. Scribner, of the Chicago office of the General Electric Company, is the secretary. Electrical manufacturers and dealers represented in the Manufacturers' Association are heartily in accord with the objects of the parent association, and are enthusiastic over the prospects for an unusually successful convention in Chicago next month.

## Electricity for California Oil Fields.

The San Joaquin Light & Power Company, of Fresno, Cal., has purchased the holdings of the Power, Transit & Light Company in and about Bakersfield, Cal., together with the properties of the Merced Falls Gas & Electric Company in and about Merced, Cal. The purchase of these important properties has been made in order to secure a market for the large amount of electrical energy that will be produced by the San Joaquin company in the Crane valley on the north fork of the San Joaquin River. The newly acquired plants will be the basis of a system by which the company will supply the Kern, Midway and Maricopa oil fields with electricity for the operation of oil wells.

A large amount of the electricity now produced by the San Joaquin company is used in the reclamation of heretofore waste land around Fresno and in the pumping of water for irrigation purposes, but there will be a surplus for which the generating company is finding a new market. It has been shown that oil wells are very satisfactorily and economically operated by electric pumps, and it is proposed to use the electrical energy in the drilling of wells also.

The Power, Transit & Light Company, of Bakersfield, not only furnishes gas and electricity used in and near that city, but also owns and operates the street-railway system. The Bakersfield power house, which is now supplying the necessary electricity for these operations, will be used in the future as a substation. Electrical energy will be supplied to it at high potential by a transmission line which will connect the San Joaquin company's generating station near Porterville with Bakersfield, a distance of about 70 miles. A second transmission line from Madera to Merced, to supply the Merced system, is now under consideration.

There are three power development sites on the San Joaquin River that may be utilized eventually. At site No. 1 a dam 125 ft. high is being erected, which, when completed, will be more than 1200 ft. in length. When this dam is in use a lake 5 miles in length and more than 16 miles in circumference will be formed. The dam and power plant at this point will cost fully $1,250,000 when completed. The other dam sites are below the dam now under construction, but will not be developed until the capacity of the plant now building is reached.

Los Angeles business men are largely interested in the San Joaquin Light & Power Company, the president, Mr. W. G. Kerchkoff; the vice-president, Mr. Allan C. Balch; the secretary, Mr. L. M. Farnham, and the treasurer, Mr. K. Cohn, being from that city. The general manager is Mr. A. G. Wishon, of Fresno.

## Montreal Light, Heat and Power Company Controversy.

For a year and a half or more the Montreal Light, Heat & Power Company has been lighting the streets of Montreal, Canada, without any agreement with the city as to price, except that it is to be "at such rate or charge as we (the company) may consider fair and equitable to both parties under the circumstances."

A five-year contract for furnishing 1666 arc lamps and a small number of incandescent lamps equivalent to 148 arc lamps, making a total of 1814 equivalent arc lamps, expired Dec. 31, 1908, without any arrangements having been made between the city and the company for continuing the contract. Negotiations had been carried on for over a year, during which time the City Council had endeavored to award the contract to a syndicate which proposed to erect a new plant, but was prevented from taking this action by an injunction. After further negotiations early in 1909 the present indeterminate price was accepted by the city authorities on the basis of a proposal made by the company on Jan. 14, 1909. The significant passage of the proposal is as follows:

"The Montreal Light, Heat & Power Company will be pleased for the time being, and until further notice, to continue lighting the present limits in that portion of the city streets not already under contract with the company, at such rate or charge as we may consider fair and equitable to both parties, under the circumstances, but such charges we will always be prepared to submit to arbitration."

The supply was continued and the company forwarded accounts to the city now amounting in all to over a quarter million of dollars. These accounts the city contests on the ground that they are excessive.

A few months ago the Montreal Light, Heat & Power Company began suit against the city for the amount it claimed due for the service rendered, on a basis of about $90 per arc lamp per year. The court agreed, with the consent of both parties to the suit, to the appointment of a Board of Arbitrators consisting of three men—one to be selected by the city, one by the

company and these two to select the third. The Board of Arbitration appointed accordingly consists of: Prof. L. A. Herdt, of the electrical engineering department of McGill University; Mr. R. G. Black, general superintendent and engineer of the Toronto Electric Light Company, and Mr. A. A. Dion, general superintendent and chief engineer of the Ottawa Light, Heat & Power Company.

The legal interests of the city are in the hands of Messrs. O. Lavelle, K.C., and W. H. Butler, of the city legal department, and Mr. G. H. Montgomery, K.C., represents the company. The engineering experts for the city are Messrs. Robert A. Ross, of Ross & Hoguet, consulting engineers, Montreal, and W. J. Robinson, general superintendent of the Dominion Electric Company, Montreal. The lighting company is represented by its chief engineer, Mr. R. M. Wilson; Mr. Henry Floy, consulting engineer, of New York, and Mr. R. S. Kelch, of Montreal.

The first hearings conducted by the arbitrators were held in the Court House, Montreal, on July 26 and 27. Mr. Montgomery began the proceedings for the company by giving a history of the contract between the Royal Electric Company—afterwards merged into the Montreal Light, Heat & Power Company—and the city, by which the latter was to pay $60 per arc lamp per year. This contract expired Dec. 31, 1908, and no renewal was effected, though there had been some negotiations between civic representatives and the company. The company maintained that it was losing money at $60 per lamp and announced that it would not accept a new contract at such a low figure. Mr. Montgomery then reviewed the negotiations which led finally to the appointment of the present Board of Arbitration. On one occasion, the city had suggested a method of arbitration which Mr. Montgomery referred to as "a ridiculous proposal, which was never intended to be taken seriously." Following the expiration of the contract, the company had declined to supply lighting at the former contract rate. Periodical accounts were submitted to the city for lighting supplied subsequent to the expiration of the contract, and these, the company contended, were fair and equitable to both parties under the circumstances.

In reply to a question from one of the arbitrators, Mr. Montgomery said he included in the term "under the circumstances" all that had led up to the present situation—to the fact that the lighting was not supplied under a contract, but from month to month, and was subject to voluntary cancellation at any time.

Mr. W. H. Butler contended, in reply, that the pourparlers leading up to the present situation were not pertinent to the case. A contract did exist between the Montreal Light, Heat & Power Company and the city, by virtue of the letter of Jan. 14, 1909, but there was no duration to such contract, and the city was bound to pay "a fair and equitable price." The fact that there had been pourparlers had nothing to do with determining the price of the commodity, and these did not come in under the words "under the circumstances."

"The arbitrators are called upon," Mr. Butler added, "to determine what is a fair and equitable price in virtue of the letter of Jan. 14, 1909. We say that you are not charging a fair and equitable price."

Argument then turned on a motion made by counsel for the city for more particulars of the accounts. Mr. Montgomery opposed the motion on the ground that it was nothing less than an appeal from a ruling made by Mr. Justice Lafontaine declining to grant a similar motion. The Board of Arbitration denied the motion, the city thus losing the first point.

The company then called its first witness, Mr. Arthur Parent, superintendent of the city lighting department, who testified with regard to the city's contracts with the Royal Electric Company, the predecesor of the Montreal Light, Heat & Power Company, and recited facts concerning negotiations between the company and the city looking toward a new contract before the expiration of the preceding five-year contract, which expired Dec. 31, 1909.

At the second day's hearing, the lawyers continued to raise legal objections and legal questions, which caused proceedings to advance slowly. The company called Mr. R. M. Wilson, its chief engineer, to testify at length regarding the arc-light service furnished the city, and on the exacting requirements, such as the necessity for maintaining an extensive patrolling staff, which practically goes over the whole lighting system every night, as penalties are exacted in case of failure of the lights for even brief periods. Mr. Wilson also described the physical property of the company, which includes three steam reserve plants with operating crews, always maintained ready to take up load in case of an accident to any or all of the four water-power plants, which normally furnish all electrical energy, namely, the Shawinigan, the Chambly, the Lachine and the Soulange plants. The current is delivered within city limits at different voltages, the maximum being 44,000 volts. The Shawinigan plant delivers the largest amount of power over a transmission line, approximately 80 miles in length. The arc service is supplied mainly through overhead lines aggregating 310 miles in length connected with three substations advantageously located in different portions of the city.

On account of the illness of the general manager of the Montreal Company, hearings were adjourned for two weeks, until Aug. 10, when the company will submit figures in detail showing investment costs, maintenance, depreciation and other items relating to the expense of maintaining arc service.

## New President for the Westinghouse Electric & Manufacturing Company.

At the annual meeting of the stockholders of the Westinghouse Electric & Manufacturing Company held in Pittsburgh on July 27 the four members of the board of directors whose terms expired at that time were re-elected. These directors are Messrs. A. G. Becker, Chicago; George M. Verity, Middletown, Ohio; William McConway, Pittsburgh, and Charles A. Moore, New York.

Pres. Edwin F. Atkins.

At a meeting of directors held in New York on July 29 all of the former officers, consisting of Messrs. Robert Mather, chairman of the board of directors, New York; George Westinghouse, president, Pittsburgh; E. M. Herr, first vice-president, Pittsburgh; L. A. Osborne, second vice-president, Pittsburgh; Charles A. Terry, third vice-president, New York; G. W. Hebard, acting vice-president, New York; H. D. Shute, acting vice-president, Pittsburgh; W. A. Esselstyn, secretary, New York; T. W. Siemon, treasurer, Pittsburgh; H. F. Baetz, assistant treasurer, Pittsburgh; E. St. John, assistant treasurer, New York; James C. Bennett, comptroller and auditor, Pittsburgh, and W. B. Covil, Jr., assistant auditor, Pittsburgh, were re-elected with the exception of the president.

Mr. Edwin F. Atkins, a director in the company, was chosen president temporarily. Mr. Atkins was born in Boston in 1850,

and received his education in the private schools of that city. In 1903 the honorary degree of A.M. was conferred upon him by Harvard University. He is principally known as a manufacturer and importer of Cuban sugars. He was president of the Bay State Sugar Refinery Company in 1878-88, and a partner in E. Atkins Company, importers of sugars, commission merchants and bankers, since 1874. He was also vice-president and director of the Union Pacific Railway system from 1889 to 1895. He is now president of Ætna Mills Soledad Sugar Company, Cuba; Trinidad Sugar Company, Cuba; Boston Wharf Company, and director of American Trust Company, Eliot National Bank, West End Street Railway, Guarantee Company of North America and the American Sugar Company. Mr. Atkins' home is at Belmont, Mass. He is a member of the Belmont Spring Club, the Oakley Country Club, the Brookline Country Club and the Boston Exchange Club.

## Ohio Electric Light Association Convention.

The sixteenth annual convention of the Ohio Electric Light Association was held at Cedar Point, on Lake Erie, near Sandusky, July 26, 27 and 28, 1910. The registration reached 355, exceeding all previous records. It seemed to be generally agreed that the association has at last found a satisfactory convention place which is free from the heat of the larger cities and more convenient than Put-in-Bay Island, where so many of the former conventions have been held. Cedar Point is a bathing resort located just across Sandusky Bay, about 15 minutes from Sandusky by boat. Hotel Breakers furnished the accommodations.

The first session was scheduled for Tuesday morning, but owing to lateness of arrival of many, the session was postponed and consolidated with the afternoon session of that day. The first session was therefore called to order at 2 p. m. Tuesday. President J. C. Rothery, of East Liverpool, having moved from the state, the duty of presiding fell upon Vice-President E. H. Beil, of Youngstown. In his opening address Mr. Beil called attention to the fact that the Ohio Electric Light Association is now second only to the National Electric Light Association in strength and number of members, which fact should be a source of much satisfaction to the Ohio men. He said that the association is of well recognized value for the exchange of ideas about the management of plants, but it is even more important in enabling members to keep posted as to possible legislation and to combat bad legislation when proposed. Commenting on the rapid changes in the electric lamp situation, he called attention to the fact that it was only five years ago that Dr. Louis Bell presented a paper on the tantalum lamp before the Denver convention of the N. E. L. A. This lamp indicated a saving of 40 per cent over the older types, but in five years it has been superseded by the much more efficient tungsten lamp. It is impossible to tell what the next five years will bring forth. He referred to the fears entertained by many central-station companies as to the effect of tungsten lamps on earnings, stating that as a matter of fact the results had not been as bad as feared, in some cases being quite the contrary.

Mr. E. A. Bechstein, chairman of the committee on general arrangements and manager of the Sandusky Gas & Electric Company, made a brief address of welcome. This was followed by the report of the secretary and treasurer, Mr. D. L. Gaskill, of Greenville, who showed the association's finances to be in excellent shape with a balance of $446.88 in the treasury. One of the reasons for this good showing was the amount of nearly $2200 received from advertising in the association's souvenir program for 1910. This souvenir program was a very handsome piece of work bound in violet leather. The secretary announced that during the year the association had been legally incorporated as an association not run for profit. The auditing committee, consisting of Messrs. J. T. Kermode, of Cleveland, and T. D. Buckwell, of Toledo, reported having audited the treasurer's books and found them correct. Applications for membership from 14 central-station companies for active membership and 8 manufacturing and supply concerns for associate membership were received and accepted.

Certain amendments to the constitution which were discussed at the last convention were again brought up, these amendments covering the method of electing officers and appointing the nominating committee. The amendments were drawn with a view of preventing clique rule and at the same time assuring the selection of men who are familiar with the policies and methods of the association and who have demonstrated their willingness to work. As Mr. M. E. Turner, of Cleveland, who drafted these amendments and who has given the subject much attention, was absent, and as no other members felt competent to discuss the change without further study, the matter was tabled, with the understanding that it would be taken up at a later session if Mr. Turner arrived, or if not, at the next convention.

### STEAM TURBINES.

The first paper taken up was "Low-Pressure Turbines and Their Operation," by W. C. Anderson, manager of the Canton Electric Company. He briefly discussed the advantage of the steam engine for utilizing high boiler pressures and the turbine for utilizing pressures below atmospheric or vacuum, and described an installation of a 500-kw turbine which his company has made at Canton. This is a combined mixed and low-pressure turbine, which fits very well into conditions in that station.

The second paper was by Mr. Frank Brosius, of the Columbus Railway & Light Company, on "Turbine Troubles." All of the Columbus men being absent on account of the street railway strike at Columbus, this paper was read by Mr. F. M. Tait, of Dayton. Abstracts of these two turbine papers are given elsewhere in this issue. Their presentation brought out considerable discussion, which was participated in by Messrs. W. S. Townsend, of East Liverpool; John C. Gilmartin of Toledo, and others. This discussion ended the Tuesday afternoon session.

On Wednesday morning after announcements by the secretary of entertainment features, Secretary Gaskill moved that a nominating committee be appointed according to the proposed amendments to the constitution, namely, that the association elect two members, that the president appoint one member and that the two retiring members of the executive committee act on the nominating committee. This motion being carried Messrs. S. M. Rust, of Greenville, and F. O. Plymale, of Gallipolis, were elected members of the nominating committee by the association. The president appointed Mr. W. J. Hanley, of the General Electric Company, Cleveland. The two members from the executive committee consisted of Mr. W. P. Engle, of Defiance, and Mr. W. F. Hubbell, of Wauseon, these being the retiring members of the executive committee.

### MODERN SINGLE-PHASE MOTORS.

Much interesting information concerning the present standing of single-phase motors, the available types and their relative advantages, was given in a paper by Prof. F. C. Caldwell, of the Ohio State University. The author outlined the performance characteristics of the series motor, the induction motor, the repulsion motor and the repulsion-induction motor. One or more of these types are made in this country by 10 different manufacturers. The motors range in rating from 0.05 hp to 50 hp, with efficiencies from 50 to 87 per cent and power factors from 50 to 99.5 per cent, the highest power factor being obtained with the repulsion-induction motor. Of the total of 1043 motors used by 18 of the member companies, 70 per cent were rated at not over 1 hp, while less than 1 per cent had a rating above 5 hp.

In the absence of Prof. Caldwell his paper was read by the secretary. The paper was briefly discussed by Mr. B. H. Gardner, of Dayton.

### ELECTRIC VEHICLES.

"What Progress Is Being Made in the Introduction of Electric Vehicles in Ohio" was the subject of a paper by Mr. J. T. Kermode, of Cleveland, who gave electric vehicle statistics from a number of cities showing Cleveland to be in the lead. This paper was discussed at considerable length by Messrs. R. E. Russell, of the General Electric Company; D. L. Gaskill, of

Greenville; C. W. Chapelle, of the Electric Storage Battery Company; R. W. Lagenke; John Gilmartin, of Toledo; F. M. Tait, of Dayton; W. C. Anderson, of Canton, and W. R. W. Griffin, of East Liverpool.

BUSINESS-GETTING METHODS.

In a paper entitled "Methods of Obtaining New Business in Cities of Fifteen Thousand and Less," Mr. L. A. Pettit, Jr., of the Middletown Lighting Company, discussed the scope, organization and management of a new-business campaign in a city of the size designated. The author claimed that as much, if not more, time and money should be expended in the education and in the stimulation of interest among present consumers as among prospective consumers. He laid particular emphasis on the desirability of gathering complete information as to existing conditions in the community, this information being tabulated as simply and conveniently as possible. The data should cover the location and description of each residence or office building whether wired or not, and each factory, specifying the output operating conditions, motor and lighting service requirements. The information can be kept best by means of a card-index system arranged according to the location of the buildings; various colored cards may be used to distinguish between wired and unwired buildings. The employees of the company should be well-instructed solicitors thoroughly familiar with the latest developments in energy-consuming devices. The company should maintain a show-room for displaying all electrical appliances that can be classed as necessities rather than luxuries.

In discussing this paper Mr. W. S. Townsend told of some novel methods used at East Liverpool for advertising the company.

TUNGSTEN STREET LIGHTING.

On Wednesday afternoon Mr. Claude C. Smith, of the Bradford & Gettysburg Electric Light & Power Company, read a paper giving his experience with series-tungsten lamps for street lighting. This was followed by a similar paper by Mr. C. C. Custer, of the Miami Light, Heat & Power Company, Piqua, Ohio. Messrs. C. J. Crippen, of Youngstown; W. S. Townsend, of East Liverpool; J. R. Cravath, of Chicago; James O'Toole, of Hamilton; F. Glosser, of Marion; Harry G. Glass, Westinghouse Company, and others, gave their experiences with tungsten street lighting. Abstracts of these papers and the discussions are given elsewhere in this issue.

TRANSMISSION OF ENERGY.

Mr. D. L. Gaskill called attention to the growing importance of long-distance transmission to supply small towns with energy from a central plant and moved that the chair appoint a standing committee of three on long-distance transmission to make a report at the next convention. This motion was carried.

EFFECT OF TUNGSTEN LAMPS UPON THE RATES FOR ENERGY.

A clear discussion of the relation between high-efficiency lamps and rates for energy for lighting service was given in a paper by Mr. E. L. Booth, of the Bellaire Light & Power Company. The author remarked that without question any condition which retards the adoption of a more efficient means of production, is fundamentally, from an economic standpoint, at serious fault. A more efficient means of converting electrical energy into light should create an actual economic saving to the central station. However, under most of the existing methods of charging for electrical service and electrical energy all of the economic saving created by the high-efficiency lamp goes to the consumers, and sometimes they even secure a reduction in the cost of light greater than the actual economic saving; the difference, of course, is direct loss to the central station.

In order to overcome the present defects the central station's costs which are proportionate to the maximum demand and those which are proportionate to the number of consumers should be combined and applied to the consumer as a service charge. They should be applied in such a way that the convenience of electrical service will not have to be sacrificed on account of prohibitive cost, and in such a way that the small consumer will not feel that he is being discriminated against in favor of the large consumer. It should not limit the free installation of lamps or energy-consuming devices by imposing a charge on the connected load, but rather on the consumer's maximum demand upon the central station for energy. The kw-hour rate should be made so low that a reduction in the consumer's energy consumption, no matter how great it may be, could never reduce the revenue derived from the consumer below the cost of serving him and supplying him with energy. If the service charge had been equitably established the only reduction in cost the consumer would receive would be that due to the decreased consumption of energy. The revenue which the central station could earn with a given station output would then increase with the number of consumers which it could serve.

The effect of the high-efficiency lamp upon the central station's earnings resolves itself into the question of rates, and the ability of the central station to secure new business. The greatest field for securing new business with high-efficiency lamps is among the small consumers, and in the residential districts. This should improve the load factor of the central station, because with the increase in the number of small consumers the average simultaneous demand of the consumer decreases, and with a development of residential lighting, the commercial and domestic peaks not being coincident, should enable the central station to add many new consumers without increasing the maximum demand on the central station, and thus increase the earnings. With the increased number of consumers there should be greater opportunities for developing off-peak business by the introduction of flatirons, motor fans, toaster stoves, vacuum cleaners, and numerous other energy consuming devices, thus adding to the central station's receipts. The central stations should get together and formulate a uniform method of charging for electrical service and energy that will apply with equity to all sources of electrical illumination, no matter how efficient they may be, and that will make it possible for the economic saving created by the high-efficiency lamps to be fairly divided between the central station and the consumer.

In discussing Mr. Booth's paper Mr. M. B. Cooper, of the engineering department of the National Electric Lamp Association, pointed out that the effect of the tungsten lamp on earnings is largely a question of rates and he reviewed some recent ideas on the rate question in which there is a tendency to increase the fixed demand charge and decrease the output or kw-hour charge made to consumers. He favored basing the demand charge on the area to be lighted instead of the connected load. Mr. B. H. Gardner, of Dayton, pointed out some difficulties with the systems with high readiness-to-serve charges and also with the schemes for flat-rate residence lighting which have been proposed, namely, those using low-voltage tungsten lamps and those using an excess demand indicator or flat-rate controller.

OFF-PEAK LOAD.

A paper on "Securing Off-Peak Load" was read by Mr. Harry G. Glass, of the Westinghouse Electric & Manufacturing Company. He stated that the desirability of securing off-peak load is generally acceded, and what concerns most managers is how to secure this load. He then made a number of suggestions as to methods to be employed, his paper being in general similar to papers given before the Minnesota, Nebraska and Iowa conventions and already abstracted in these columns. Mr. J. C. Martin, of Wilmington, discussed this paper at length, telling of building up the day load in Wilmington where he has about 85 per cent of all the possible power business in the town.

EQUITABLE MOTOR-SERVICE RATE.

Mr. B. H. Gardner, of the Dayton Lighting Company, outlined a motor-service rate which he claimed to be equitable in all respects. The rate is based on the desirable income per kilowatt of demand rather than the income per kw-hour. As an example he fixed a rate under certain stated conditions at 12 cents per kw-hour for one hour's use of the demand per month. To this value he added a certain percentage to the

cost of producing the energy, the percentage for a use exceeding 110 hours being 30. The author claimed that it is more profitable to sell energy at 4 cents per kw-hour when the income per year per kilowatt is $100 than to obtain 15 cents per kw-hour when the income is only $50 per kilowatt per year.

Mr. Gardner's paper was discussed by Messrs. M. B. Cooper, of the National Electric Lamp Association; F. M. Tait, of Dayton, and W. C. Anderson, of Canton.

### CENTRAL-STATION FACTS AND FACTORS.

Mr. J. R. Cravath, of Chicago, presented in the form of a table, and a discussion thereof, certain facts as to the investment, income, operating data, territory served, etc., relating to 13 central stations in Ohio. The information was compiled according to the method shown in our issues for April 29, May 6 and June 24, 1909, and Jan. 13, 1910. The companies are indicated by numbers, the numbers herein used being selected to conform in sequence to the numbers shown in our issue for Jan. 13, 1910. In connection with the averages for the 13 Ohio stations are shown the averages for 26 Iowa stations tabulated in our issue for May 6, 1909.

CENTRAL STATION FACTS AND FACTORS

| Company Number | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | Ohio Aver. | Iowa Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kw-rating of stations | 80 | 100 | 120 | 110 | 202 | 80 | 205 | 120 | 450 | 1,050 | 1,150 | 1,350 | 5,500 | ..... | ..... |
| Total population of district served | 1,000 | 1,500 | 2,000 | 3,000 | 3,000 | 1,200 | 5,000 | 6,000 | 8,500 | 12,000 | 16,000 | 25,000 | 125000 | ..... | ..... |
| Total liabilities per kw of station equipment | $93 | $300 | ..... | $136 | $143 | $125 | $582 | $125 | $119 | $128 | $220 | $435 | ..... | $220 | $220 |
| Gross yearly income per kw of station equipment | $40 | $60 | ..... | $90 | $35 | $56 | $108 | $73 | $73 | $53 | $50 | $50 | $73 | $63 | $90 |
| Gross yearly income per $100 liabilities | $43 | $20 | ..... | $66 | $25 | $45 | $19 | $60 | $61 | $41 | $20 | $11.50 | $7.49 | $35 | $45 |
| Per cent. of cross yearly income spent for operation, including everything but interest and depreciation | 50 | 50 | ..... | 72 | 47 | 45 | 51 | 60 | 64 | 55 | 80 | 60 | 58 | 57.5 | 65 |
| Yearly operating expenses per $100 liabilities | $22 | $10 | ..... | $50 | $12 | $20 | $9.54 | $36 | $39 | $22 | $17 | $7 | $4.33 | $20.75 | $27 |
| Total connected load in kw per kw of station equipment | 1.0 | 4.5 | 0.5 | 1.8 | 0.81 | 1.5 | 2.9 | 0.75 | 2.46 | 1.4 | 2.0 | 1.2 | 2.0 | 1.75 | 1.8 |
| Connected kw load in lamps per kw of station equipment | 1.0 | ..... | 0.5 | 1.0 | ..... | 1.5 | 1.86 | 0.75 | 1.72 | 1.14 | 1.25 | ..... | 1.06 | 1.17 | 1.4 |
| Connected kw load in motors per kw of station equipment | 0.0 | ..... | 0 | 0.7 | ..... | 0 | 0.73 | 0 | 0.24 | 0.19 | 1.50 | ..... | 0.94 | ..... | 0.3 |
| Connected kw load in heating apparatus per kw of station equipment | 0.0 | ..... | 0 | 0.7 | ..... | 0 | 0.30 | 0 | 0.49 | 0.07 | 0.02 | ..... | ..... | ..... | 0.1 |
| Kw hours sold or accounted for per 100 kw hours generated | ..... | ..... | ..... | 90 | 66 | ..... | ..... | 90 | ..... | 74.3 | 75 | 89 | 90 | ..... | ..... |
| Kw transformer equipment per kw of alternating current station equipment | 0.8 | ..... | 1.0 | ..... | 0.5 | ..... | ..... | 2.5 | ..... | 0.5 | 0.5 | 3.7 | 1.82 | 1.41 | 1.1 |
| Kw transformer equipment per kw of connected load | 0.8 | ..... | 2.0 | ..... | 0.56 | ..... | ..... | 0.88 | 0.55 | 0.5 | 0.37 | 0.46 | ..... | 0.76 | ..... |
| Kw transformer equipment per kw connected in residence district | 0.8 | ..... | ..... | ..... | ..... | ..... | ..... | 0.83 | ..... | 0.61 | 0.25 | ..... | ..... | 0.62 | ..... |
| Kw station equipment per employee all departments | 80 | 50 | 60 | 27 | 67 | 40 | 10 | 60 | 50 | 50 | 100 | 50 | 50 | 53 | 63 |
| Yearly load factor—per cent | ..... | 28.8 | ..... | 23 | 27.4 | ..... | 26.4 | 22 | ..... | 30 | 25 | 30 | 28.1 | 26.8 | 32 |
| Gross yearly income per capita of population | $3.20 | $4.00 | ..... | $3.30 | $2.40 | $3.75 | $4.44 | $1.20 | $3.48 | $4.64 | $3.50 | $2.72 | $3.23 | $3.30 | $3.93 |
| Liabilities per capita | $7.40 | 20.00 | ..... | $5.00 | $9.66 | $8.35 | $2.30 | $2.50 | $5.70 | $11.21 | $14.00 | $23.52 | $43.00 | $11.20 | $9.00 |
| Watts station rating per capita | 80 | 66 | 60 | 37 | 67 | 66 | 41 | 20 | 47 | 87 | 64 | 54 | 44 | 56 | 44 |
| Number of consumers per 100 of population | 7.5 | 13 | 2.5 | 9.6 | 4.0 | 8.9 | 10.22 | 3.0 | 10.8 | 7.9 | 6 | 4.3 | 3.12 | 7.0 | 9.0 |
| Number of residence consumers per 100 of population | 5.5 | 10 | 2.2 | 6.0 | 1.0 | 7.0 | 5.44 | 1.5 | 9.0 | 5.8 | 4 | 2.7 | ..... | 5.0 | ..... |

Mr. D. L. Gaskill pointed out that although much thought had been given to simplifying these items so that any company which has its records in proper shape could fill them out, a number of companies had reported to him that they did not have the necessary records to answer these questions. Mr. Gaskill expressed the opinion that any company which is so ignorant of the fundamental facts of a business as to be unable to supply most of the information called for in the table which had been presented is like a ship in dangerous waters and should get in shape immediately to know what it is doing. Mr. J. C. Martin, of Wilmington, also spoke strongly as to the value of a comparison of this kind of statistics and urged that a standing committee continue this work. Mr. D. L. Gaskill moved that the matter of collecting information of this kind be referred to the publicity committee in connection with Mr. Cravath and make another report at the next convention. This was carried. Mr. C. W. Lee, of New York, expressed the opinion that there is too much of a tendency among central-station companies to withhold information of this kind. If they have such information available there will be less trouble in store for them when control by commission becomes the law.

### ELECTION OF OFFICERS.

On Thursday afternoon the opening of the session was occupied with appointment of committees and election of officers. The president announced the appointment of the following committee on long-distance transmission in accordance with a motion carried at a previous session: Messrs. J. T. Kermode, of Cleveland; W. S. Townsend, of East Liverpool, and John C. Gilmartin, of Toledo.

Officers for the ensuing year, in accordance with the recommendations and report of the nominating committee, were elected as follows: President, Mr. E. H. Beil, of Youngstown; vice-president, Mr. W. C. Anderson, of Canton; secretary and treasurer, Mr. D. L. Gaskill, of Greenville. Executive committee, Messrs. E. A. Bechstein, of Sandusky; Sheldon Roberts, of Columbus; J. C. Martin, of Wilmington; W. S. Townsend, of East Liverpool, and W. E. Richards, of Toledo; advisory committee, Messrs. Samuel Scovil, of Cleveland; F. M. Tait, of Dayton, and D. L. Gaskill, of Greenville; publicity committee, Messrs. E. L. Booth, of Bellaire; C. M. Lott, of Hicksville, and Claude C. Smith, of Bradford; finance committee, Messrs. J. T. Kermode, of Cleveland; B. H. Gardner, of Dayton, and F. O. Plymale, of Gallipolis; membership committee, Messrs. W. J. Hanley, of Cleveland; E. Van Winkle, of Cleveland; Paul Stewart, of Cincinnati; P. J. Williams, of Columbus; F. C. Caldwell, of Cincinnati; N. C. Cotabish, of Cleveland, and I. M. Cassell, of Cleveland.

Mr. F. M. Tait, of Dayton, spoke in the highest terms of the work done for the association by its secretary, Mr. D. L. Gaskill, and said that the salary was nowhere near commensurate with the value of the work. Frequently Mr. Gaskill was obliged to neglect his own work to look after association matters. He moved an increase in the secretary's salary from $750 to $1200 per year. Mr. J. C. Martin, of Wilmington, seconded this motion and in doing so called attention to the broad field of increased usefulness which is opening before the association. He referred especially to the work which might be done in connection with insurance rates and in helping to frame up legislation under which the companies can operate if commission regulation is to come. The motion was carried.

### TESTING WATT-HOUR METERS.

Mr. John Gilmartin, of the Toledo Railway & Light Company, arranged for publication, with personal comments, the replies received from the member companies to questions relating to the methods employed and advocated for maintaining the accuracy of watt-hour meters in electric lighting and motor service.

Following the presentation of Mr. Gilmartin's paper, Mr. John T. Kermode, of Cleveland, moved that a standing committee be appointed to make a report at the next convention. This was carried and the president appointed Messrs. John Gilmartin, of Toledo; J. T. Kermode, of Cleveland, and O. H. Hutchings, of Dayton.

### THE PURCHASE OF STATION APPARATUS.

In a paper entitled "Best Methods to be Followed in the Purchase of Station Apparatus," Mr. R. J. Feather, of the Columbus Railway & Light Company, outlined a method to be used

in selecting apparatus for a generating station. The method is based on the relative total costs of the apparatus offered, the costs including not only the initial installation, but the running expense and depreciation capitalized. The interest on these costs are compared with the yearly cost of the energy lost and selection is made of that apparatus which shows the lowest relative energy lost on the basis of its total cost.

In the absence of the author, this paper was read by Secretary Gaskill. After a short discussion of the paper, Mr. Bechstein, of Sandusky, moved the appointment of a committee on motor applications to report at the next convention. This was carried and the president appointed Messrs. E. A. Bechstein, of Sandusky; C. I. Crippen, of Youngstown, and B. H. Gardner, of Dayton.

Mr. F. M. Tait, of Dayton, moved that a vote of thanks be extended to Mrs. Clara Turpen Grimes, of Dayton, and Mrs. Mannix for the very enjoyable music furnished at various occasions during the convention, and to Mr. P. B. Arnold, of the Union Spring Company, Pittsburgh, Pa., for his sleight-of-hand entertainment Tuesday evening; also to the management of the Cedar Point hotel and resort for the excellent provisions for the convention. The convention then adjourned.

THE PRESIDENT ELECT.

Mr. E. H. Beil, president-elect, is assistant engineer of the Mahoning & Shenango Railway & Light Company, which is the holding company controlling six companies, including the

Pres. E. H. Beil.

Youngstown Consolidated Gas & Electric Company. Mr. Beil's work is the management of the light and power department of the Youngstown Consolidated Gas & Electric Company, in which work he has been engaged since 1905. Mr. Beil received a common-school education and started as an oiler in the plant of the Youngstown Electric Light Company in 1893. He worked up through various positions to that of superintendent of the light and power company in 1905. He is 35 years old, and for a number of years past has been active in Ohio Electric Light Association affairs.

ENTERTAINMENT FEATURES.

Cedar Point has probably the finest bathing beach on the Great Lakes. Although various other entertainment features were provided, bathing naturally led the list. For the ladies during the convention sessions music and cards were the order of the day Tuesday and Thursday afternoons. Wednesday afternoon they were taken for a launch ride on Sandusky Bay and Thursday morning were given a bowling party.

Tuesday evening at 7 o'clock the entire association was tendered an informal dinner at the Breakers Hotel, after which Mrs. Clara Turpen Grimes sang a number of times to a very appreciative audience, and Mr. T. B. Arnold gave some very mystifying sleight-of-hand performances with cards. This dinner was followed by a visit to various attractions of the Cedar Point resort, for which tickets were provided for all attending the convention. On Wednesday evening there was a banquet at 7 p. m., at which music was the entertainment. Mrs. Grimes again sang a number of selections, and the convention joined in singing a number of popular songs, the words of which were printed and distributed with the menus. This was followed by dancing at the dancing pavilion. Thursday evening the theater was visited.

## Tungsten Street Lighting Experience.

At the Cedar Point convention of the Ohio Electric Association, Mr. Claude C. Smith, of Bradford, Ohio, presented a paper outlining the experience of the Bradford & Gettysburg Electric Light & Power Company with series tungsten lamps used for street lighting. In November, 1908, the company installed a series street-lighting system using the 75-watt, 60-cp tungsten lamp, which was the largest unit then available. The specifications of the local committee on street lighting called for mast arms not less than 16 ft. long, the lamps to be 16.5 ft. above the roadways. These mast arms were built by the local linemen and were of 1.25-in. iron pipe trussed with the ⅜-in. iron rods, which were spread about 18 in. apart near the center of the area by a V-shaped spreader iron. The arms cost complete installed on poles about $4 each. Four men with a horse and wagon erected on an average of 20 arms per day. On the last installations the ⅜ truss was displaced with No. 4 steel messenger cable, which makes the work of erecting and adjusting the arms much easier. These mast arms have given little trouble, there having been only one failure, which was due to the heel bolts pulling out of the pole; the truss rods prevented the arm from coming in contact with the ground and was in no way damaged, the lamp filament remaining intact. Two instances were noted where the slip socket was blown from the hood by violent wind storms. The actual number of lamp filaments broken by storms was three for the year. Four lamps were broken by stones and other missles, 57 lamps were lost by burnouts and 35 lamps proved defective after a few hours' burning due to the failure of the cement joint between the filament and the leading-in wires. This defect was notable only on the first consignment of lamps and they were replaced gratis by the manufacturer.

While different makes of lamps were tried, the experience showed that they all have weak features, such as poor joints, early blackening and short life. At present these faults are almost eliminated. Six series sockets have been destroyed by excessive arcing across the film cut-outs. On the Gettysburg installation of 20 lamps gauze film cut-outs were first installed, but they gave some trouble from jumping over and were too sensitive. They were replaced with mica strips. This 20-lamp installation receives energy from the 220-volt mains through a 3-kva, variable-tap transformer and a series regulator; the 60-lamp plant has a 11.5-kva, variable-tap transformer and a series regulator. The variable-tap transformers are arranged with taps at 12.5 per cent, 25 per cent, 37.5 per cent, 50 per cent, 62.5 per cent, 75 per cent, 87.5 per cent and 100 per cent voltage. The series regulators have given excellent service, which is corroborated by the small number of lamp renewals. With regulators of this type no short-circuiting device is required for starting, the 220-volt primary on the installations being opened and closed by 8-day time switches. These switches gave some trouble during the extremely cold weather of last winter and frequently stopped about the hour when the arc circuits were due to be cut out in the mornings. This trouble was eliminated by installing small heating elements (about 15-watt consumption) inside the clock cases.

The life of the 75-watt, 60-cp, series tungsten street lamps has been very good, in fact much better than was expected. The average life of lamps for the Bradford installation of 60 lamps from Feb. 1, 1909, to Feb. 1, 1910, was about 2300 hours. The maximum life of the oldest lamps on June 25 was 5280 hours, and these lamps are still in service.

The lamps are spaced about 400 ft. apart and give satisfactory illumination.

A second paper on the same subject was presented by Mr. C. C. Custer, of the Miami Light, Heat & Power Company, which has used the series incandescent lighting system for about 10 years. The first installation consisted of 32-cp, 5.5-amp carbon lamps consuming 4 watts per candle, receiving energy from an alternating-current system through a constant-current regulator. Subsequently use was made of 4-amp, 32-cp graphitized carbon lamps consuming 2.7 watts per candle. In 1908 the 32-cp tungsten lamp consuming 1.25 watt per candle was adopted. The carbon lamps had an average life of 1200 hours, the graphitized carbon lamps operated for about 800 hours each, while the average life of the tungsten lamps has been about 3300 hours, excluding those that proved defective initially. About 20 per cent of the tungsten lamp breakage was the result of causes outside of the lamp itself; namely, crosses with high-tension wires, lightning discharges and the vandalism of small boys. Those broken by lightning are easily distinguished by a kink almost always found in the filament.

The higher first cost of the series tungsten lamp is more than offset by its longer life. It gives a better quality of light than the carbon or graphitized lamp, and a decided saving is made in the energy necessary to operate the lamp. The lamp is possibly a little more fragile than the carbon series lamp, but there ought to be very little breakage from this cause if the lamps are installed properly. In order to protect the lamp from vibration it is better to suspend the lamp from a span wire or other flexible means of support and avoid rigidly attaching the lamp. Where a mast arm is used it is better to have the mast arm terminate in a pulley through which the lamp may be suspended by a rope and not rigidly attached to the mast arm. The tungsten lamp is also better fitted for operation on series circuits than the carbon or graphitized lamp for the reason that it will withstand surges of current without injuring the filament.

In series incandescent lighting there is always some trouble experienced with open circuits, because if a lamp is broken when the current is not on the circuit, the open place must be located before the circuit may be put in operation. In case of an open circuit it is hazardous to the life of mercury-arc rectifier tubes to attempt to puncture the cut-out films in the lamp by throwing the tube on the circuit. However, the trouble from open circuits has been minimized by the following method: A series receptacle is put on each arc panel of the switchboard and when the arc circuit is not in operation a 4-cp lamp is run in series with the circuit all day, from current furnished from the neutral and one of the outside wires of the Edison three-wire system. These pilot lamps give a continuous visual test of the condition of the circuit in regard to the open circuits or grounds, so that the state of the circuits can be seen at a glance and open circuits immediately detected.

DISCUSSION.

Mr. C. I. Crippen, of Youngstown, said that on two occasions his company had lost every tungsten lamp on a circuit; the cause was not exactly known. It was supposed to be due to a "cross" or kick in the regulator. The series-tungsten lamps are very satisfactory to the citizens.

Mr. W. N. Townsend, of East Liverpool, said that his company operates 60 series-tungsten lamps on an arc-lamp circuit. Some trouble from breakage had been experienced where tungsten lamp-bracket fixtures had been placed on poles from which railway span wires were supported. At Midland, Pa., the constant-current transformer is operated without an attendant.

In answer to a question, Mr. Custer said that the brackets from which trouble had been experienced in breakage of lamps were located on street railway poles. These brackets might prove all right if located on ordinary poles where there is but little jar.

Mr. Jas. O'Toole, of the Hamilton (Ohio) Municipal Plant, reported having in operation 300 tungsten lamps. He ties the constant-current regulator arm so as to limit the current to 7.5-amp maximum. The operation had been very satisfactory.

Mr. O'Toole suggested that if the tungsten lamps were hung in the center of the street in such a competition it would give the electric lamp an advantage which the gas lamp could not show.

Mr. F. Glosser, of Marion, told of losing a street-lighting contract with tungsten lamps in competition with gas-mantle burners. The gas-mantle burners were claimed to be of 100 cp. The council and citizens agreed that the tungsten lamps of lower rated candle-power really gave more light, but the high rating of 100 cp for the gas-mantle burners, he said, secured the business to gas.

Mr. J. R. Cravath, of Chicago, told of some tests of gasoline street lamps which had been made in that city, which showed that the mantle burners were far below their rated 60 cp. Most of them were below 30 cp and many below 20 cp, yet a gasoline burner is much more likely to maintain its candle-power than is a natural gas burner because of the variation in pressure. If, therefore, a company could get a street-lighting contract based on actual performance rather than on rated candle-power, the tungsten lamp would be sure to come out ahead.

Mr. Harry G. Glass told of his experience with a Pennsylvania central station in which a street-lighting competition came up, and wonderful claims were made for the candle-power of the gas lamp. By taking the council over to a neighboring town where gas lamps had been in service for some time and the candle-power had depreciated, the day was won for the electric light.

Mr. W. C. Anderson, of Canton, suggested that if the gas company does not furnish the candle-power contracted for, a test of the lamps in service is in order. In his case he had convinced the council that actual performance rather than rated candle-power should be considered.

## Co-operation in Selling Electricity and Electrical Goods.

The last meeting of the Electric Club of Chicago for the season, on July 27, was marked by an informal discussion on "Co-operation Between Central Stations and Manufacturers of Electrical Appliances." At least, that was the title given in advance, although the discussion broadened out to include co-operation with the jobber, dealer and contractor. The first speaker was Mr. H. E. Niesz, manager of the Cosmopolitan Electric Company, who called attention to the diversified demand made by central-station companies on manufacturers for electrical machinery and supplies. This demand begins in the generating station itself, and includes the transmitting and distributing lines connecting the power house with the customer's premises. The large quantity of different kinds of electrical apparatus needed to supply this demand is remarkable. The investment necessary on the part of the central station is very large, and the fixed costs on it constitute a large proportion of the cost of producing electrical energy. The cost of the transmission and distribution, including conduit, cables, junction boxes, transformers, overhead lines, lightning arresters, etc., is perhaps three or four times the entire cost of the generating station itself.

This business is placed with the manufacturers by the central-station companies themselves, but in addition, there is the large item composed of energy-consuming devices installed on customers' premises, such as lamps, motors, meters, heating appliances, etc. Sometimes these are purchased by the company and sometimes by the customer. To show the element of cost entering into the production of electrical energy by the amount spent by central-station companies in buying supplies from manufacturers, Mr. Niesz mentioned one item. He said that every kw-hour sold in Chicago, for instance, contains a charge of ½ cent for lamp renewals where standard carbon-filament lamps are used. This fact illustrates the extent to which manufacturers are interested in the central-station business.

How to bring about better co-operation between the central stations and manufacturers is a problem. Mr. Niesz considers that one opportunity for reaching a better understanding is afforded by the electrical show. Here the sellers of electricity

and of electrical apparatus can meet and assist each other. One class is largely dependent on the other. Devices for the use of electricity must be available before electricity can be sold. The electrical show affords one means of co-operation, but there are many other ways of "getting together" which may be employed.

Mr. E. L. Callahan, of H. M. Byllesby & Company, touched on the merchandising of energy-consuming devices. The central station has only recently awakened to the necessity of establishing new-business departments and of having a management combining commercial skill with engineering ability. Electric-service companies, even in small towns, are now endeavoring to sell electrical energy at all hours of the day. Manufacturers should, and do, co-operate by sending representatives to spend some time with the central-station companies, going out with the representatives of the latter to visit possible customers and to make tests and give expert advice in cases where steam or gas engines may be replaced by motors, for example. The manufacturers' experts thus actually help the central-station men to get the business. This missionary work increases the business of both the manufacturer and the local company, and methods of this kind should be retained and extended. This form of co-operation may be extended almost indefinitely, and may be applied not only to motors, but to signs, heating appliances and many other classes of work.

Mr. S. F. Dibble, of the General Electric Company, referring more particularly to the sale of motors, said that the central stations depend to an increasing extent on the manufacturers for direct assistance and co-operation. This assistance is readily extended, and the results are mutually satisfactory. The speaker laid especial emphasis on the maintenance of proper selling prices by central-station companies. He said that the prices established by the manufacturer should not be cut. The electrical dealers naturally resent the selling of electrical apparatus below the regular price by central stations, and their influence may prevent not a few steam or gasoline plants from being replaced by electric motors. The central station has more prestige, perhaps, than the dealer in trading with the public, and its interests and those of the manufacturer should be identical. Cut prices result in retaliation by dealers and a demand on manufacturers that may ultimately result in cheapening the product, and in some degree, at least, in a demoralization of the business.

Mr. R. H. Kilner of the Westinghouse Electric & Manufacturing Company spoke of co-operation in advertising. The manufacturers are glad to furnish attractive pamphlets, circulars and other trade literature free of charge for distribution by central stations to their customers. The manufacturer is glad to disseminate information over his own trade name. This form of co-operation also relieves the central station of much detail work. It also assures the manufacturer that the statements made refer to up-to-date machinery and supplies, and not to devices that are practically obsolete. It is beneficial both to the manufacturer and to the central station to put into service the latest types of apparatus to secure the resulting economy.

Mr. W. T. Dean, of the General Electric Company, said that his company is heartily in favor of close co-operation. Motor specialists, heating specialists, lamp specialists and others are sent far and wide over the country to do educational work. These specialists are high-grade technical men, capable of giving engineering advice of value in the various branches of the industry to which they devote their attention.

Mr. J. Scribner, of the General Electric Company, said that no argument is needed on the question of co-operation; all will agree that it is highly desirable. If the central station cannot sell its output the manufacturer cannot sell his appliances. That co-operation is very essential is, therefore, self-evident.

Mr. C. A. S. Howlett, of the General Electric Company, declared that the central station should sell electrical energy and the manufacturer should sell the devices. If the former does sell the latter's devices, it should maintain the established prices.

Mr. F. A. Ketcham, of the Western Electric Company, spoke from the viewpoint of the jobber. The jobber depends for his livelihood on the sales of electrical apparatus. If the central station and the manufacturer fail to agree and cut prices, the jobber is, perhaps, the one who suffers most. Mr. Ketcham advocated that the central station sell energy-consuming devices at a profit, and devote the profit to extending its new-business campaign.

Mr. R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company, said that all electrical men, of whatever description, should work toward making electricity more popular. Electrical men should advocate electricity all the time, for all practicable purposes, and not simply talk of motors or lamps or whatever each man's individual specialty is. All should help to create a demand beneficial alike to manufacturers, central stations, dealers and contractors.

Mr. B. G. Jamieson of the electrical engineering department of the Commonwealth Edison Company, said it is a fact that engineers generally seem to lack the commercial instinct. He quoted with approval Mr. Insull's recent advice to young engineers to familiarize themselves with the commercial conditions influencing the business of central-station companies.

Mr. Glenn Marston remarked that there are three parties to this co-operation movement, namely, the central station, the manufacturer and the contractor. By co-operation with the contractor the central station will be enabled to control the output of electrical apparatus in a given town to a large extent. He spoke of one case where the central station had organized a contractors' association. By working with this association, the central station secured business to fill up the valleys in its load curve, and at the same time the contractors were satisfied. Mr. Marston, like Mr. Howlett, endorsed what Mr. Dibble has said about maintaining prices. Cutting prices is a bad practice in any business, he said, and he concluded by emphasizing again the importance of securing the good will of the contractor.

## Indiana Electric Light Association Convention.

The second annual meeting of the Indiana Electric Light Association will be held in the Denison Hotel, Indianapolis, on August 17 and 18.

Papers will be read as follows. "Relation of Central Lighting Stations to Supply Houses," by Mr. Gordon E. Varney, Indianapolis; "Commercial Value of Low-Head Water-Power," by Mr. F. A. Bryan, South Bend; "Relation of Purdue University to Electric Public-Service Companies of Indiana," by Prof. C. F. Harding, Purdue University; "The Cost of Light," by a representative of the engineering department of the National Electric Lamp Association; "Ornamental Lighting," by Mr. E. Darrow, Indianapolis; "Municipal Ownership in Indiana," by Mr. R. A. MacGregor, Connersville; "Methods of Introducing Energy-Consuming Devices," by Mr. J. K. McDonough, General Electric Company; "New Developments in Heating Devices," by Mr. W. F. Hadaway, Westinghouse Electric & Manufacturing Company; "State Supervision of Public Utilities," by Mr. Thomas C. McReynolds, Kokomo; "Feeder and Generator Regulators," by Mr. F. W. Shackelford, General Electric Company; "Steam Heating Construction," by Mr. G. M. Williams, Indianapolis.

In addition, there will be the annual address of President C. C. Perry, of Indianapolis, an address by Mr. Charles A. Bookwalter, of Indianapolis, a Question Box and various other features. At the close of the first day's session, the visitors will be taken on an automobile trip to various places of technical interest, such as the Mill Street plant and Kentucky Avenue plant of the Indianapolis Light & Heat Company, the Washington Avenue plant of the Merchants' Heat & Light Company, the power plant of the Indianapolis Traction Terminal Company and the filter plant and pumping station of the Indianapolis Water Company. Mr. Percy Worth is chairman of the local entertainment committee. The secretary of the association is Mr. J. V. Zartman, Indianapolis.

## Ottawa Meeting of the American Peat Society.

The annual convention of the American Peat Society was held in Ottawa commencing on July 26. A large number of American visitors attended the convention, including three representatives of the United States Steel Corporation, Messrs. J. A. Gray, C. A. Meissner and W. A. Forbes, of New York.

The principal paper read on the opening day was on the history of the peat industry in Canada, by Mr. Alexander Dobson, of Beaverton, Ontario. He noted that half a century ago the peat bogs near Farnham, Quebec, for a year supplied fuel for an entire division of the Grand Trunk Railway. It was found, however, that owing to unscientific and uneconomical processes the peat supplied was not thoroughly dried, and was more expensive than coal, with the result that the producing company failed. Under better methods of peat production it was predicted that the unsuccessful attempts of the past would soon be followed by the growth of a profitable industry, supplying a large commercial and industrial need.

A résumé of the work of the society and of the peat investigation branch of the United States Bureau of Mines was given by Prof. Charles A. Davis, peat expert of the bureau at Washington. In the afternoon the members visited the Government fuel-testing plant in Ottawa, and at night were banqueted as guests of the Dominion Government.

Dr. Eugene Haanel, of Ottawa, superintendent of the Dominion Bureau of Mines, was re-elected president of the society, and the other officers were also re-elected for the incoming year.

It was decided to hold the next annual meeting of the society at Kalamazoo, Mich.

## Wisconsin Commission News.

The Wisconsin Railroad Commission, in a decision dated July 25, granted the application of the Milwaukee & Fox River Valley Railway Company for a certificate of convenience and necessity. The certificate relates to a proposed street and interurban electric railway to be built from the city of Milwaukee northward and touching the cities of Cedarsburg, Newburg, Plymouth, Elkhart, Chilton, Appleton, Fond du Lac, Kaukauna and Menasha. The company will do both freight and passenger business. The entire route lies in a territory which is one of the oldest and most highly cultivated sections in the State and a portion of it extends through what has been in the past substantially a closed domain, bounded by Lake Michigan on the east and the Milwaukee River on the west, and hitherto without railroad facilities.

The line of the Malwaukee & Northern extends northward from the city of Milwaukee on the west side of the Milwaukee River and the traffic zones of several other steam and electric roads will overlap those of the proposed road over certain very limited sections of its route. The former road was the chief objector at the first hearing held April 14, 1908, as well as at the eight subsequent hearings. Its principal objection was the threatened invasion of its profitable field in Cedarburg and in some of the territory between Cedarburg and Milwaukee. The testimony shows that this condition of affairs will be true to some extent, but while the Cedarburg business is doubtless important to the objecting road, the whole of that part of the business in controversy amounts to only a fractional part of 1 per cent upon the investment of the objector's line and can scarcely be called vital. The isolated nature of a large section of the territory to be covered by the proposed line, due largely to the fact that there are very few bridges across the Milwaukee River, will prevent any considerable encroachment upon traffic territory which naturally and legitimately belongs to the objecting roads.

A vast amount of testimony was introduced at the hearings to prove that the proposed road could never be a commercial success. But the commission says: "After carefully considering the different estimates of the cost of construction, the volume of the traffic, and the revenues to be derived therefrom, we are of the opinion that, while the project doubtless involves many uncertainties, these uncertainties do not create a risk of such magnitude as to justify this commission in denying promotors and investors the privilege of assuming it. We are inclined to the view that these risks are no greater than the risks which have been assumed many times heretofore in the projection of new railways which have since become useful and profitable institutions. There can be no question regarding the public service which the proposed line may perform in behalf of the territory through which it expects to operate; and no one can tell exactly what the financial results will be of operating a new railroad through a territory the greater part of which has never before enjoyed the facilities of a nearby line.

"It is one of the purposes of the statute under which this application is made to insure the public against the undertaking of unusually hazardous enterprises. It was doubtless contemplated to prevent the projection of lines for speculative purposes and through which the innocent purchaser would be made to suffer loss. The proposed line has been investigated at every point with sufficient thoroughness to take it out of the class of purely speculative ventures and place it upon a basis of reasonably sound business promotion. The uncertainties with respect to the probable results of operation of the project are no greater than the uncertainties which generally exist in new ventures of this character, and they are not great enough to warrant this commission in withholding the certificate which will give the investors an opportunity of trying out their scheme."

It was made evident at the hearings that grave injury would result to the objecting roads if the petitioning road were permitted to operate only certain sections of its proposed road. But the testimony showed, and the commission is convinced, that the road in its entirety is a public necessity, and that consequently the commission has no authority to authorize the construction of a portion of the line, having determined that public convenience and necessity require the construction of the whole line. The order as issued by the commission specifies in detail the exact route to be traversed and requires that the whole road shall be built and operated and not certain sections of it.

The possibilities of a rate war between the new road and the other roads were repeatedly touched upon in the proceedings. Such a possibility unquestionably exists, but it is within the power of the commission to prevent it and to compel the competitors to charge a rate which is reasonable under all the circumstances in the case. It was made very clear in the decision that such authority should be exercised if the occasion arose.

## Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission gave a hearing on July 28 upon the petition of the Grafton Electric Company for authority to purchase the Millbury Electric Company, Douglas Electric Company, Upton Electric Company, and the Uxbridge & Northbridge Electric Company. The petition requests the board to approve the issue of new stock of the par value of $242,000 in addition to a petition pending before the board for an issue of $23,000, making a total issue of $265,000. President Thos. T. Robinson appeared for the various companies.

After giving the history of the various undertakings, Mr. Robinson said that it has been the effort of the management to reduce the entire territory to a common standard of voltage, transformers, prices, etc., and as the territory is now served, a consolidation will not require any added construction, revision of prices, nor dismantling of power stations. The natural tendency of the consolidation should be along the line of reducing the prices now charged, and as a beginning of this policy a 5 per cent reduction was made on July 1. The growth of business in the territory has been remarkable. The gross receipts of all the companies for the fiscal year 1899 were $20,400, and for the year ending June 30, 1910, they were $87,700. The consolidated organization will be called the Worcester Suburban Electric Company. The present improvements at the Uxbridge power station will enable the company to produce energy eco-

nomically and in sufficient volume for several years to come. Mr. Robinson said that the consolidation will greatly simplify the management of the companies in the purchase of supplies, accounting and raising of money. The board took the case under advisement.

The commission has authorized the Electric Light & Power Company, of Abington and Rockland, to issue 540 shares of stock at a price of $150 each for the cancellation of indebtedness and the addition of equipment to the plant. The board has also approved the issue by the Suburban Gas & Electric Company, of Revere, of 1190 shares of stock at a price of $140 per share, for the meeting of indebtedness and plant extension charges.

The Worcester Electric Light Company has petitioned the board for authority to issue new capital stock to the amount of $200,000 par value, at a price of $180 per share, for the purpose of meeting the cost of building a new steam-turbine plant at Curtis Pond, Worcester, and of providing for the necessary extensions of its underground conduit and cable system.

The Foxboro Electric Company has petitioned the commission for the right to issue additional stock of $43,500 par value for the purpose of enabling the company to purchase the power plant of the Standard Gage Manufacturing Company of Foxboro. The company has recently met a demand for 24-hour electric lighting service and also for motor service on the part of large manufacturers and small consumers. It has determined that its present plant cannot be economically adapted to the new requirements. The plant to be purchased from the Standard Gage Company will be turned into a thoroughly modern central station.

The Railroad Commission has issued a decision dismissing the petition of citizens of Lawrence for an extension of the transfer privilege on the lines of the Boston & Northern Street Railway Company within the city. The board states that it appears that for 5 cents a passenger may, by means of a transfer, ride on the Haverhill line, a maximum distance of 9.27 miles, and on the Lowell line, a distance of 9.2 miles, and that both facilities are accorded residents of the Prospect Hill district in Lawrence. The board says that a consideration of these transfer privileges, taken in connection with a statement of the number of passengers carried on the Prospect Hill-Beacon Street line leads it to conclude that no recommendation ought to be made with respect to additional transfers. Regarding the petition of the citizens for additional car service, the board decided that none could be recommended, and it also declined to request the company to extend the track on Allston Street as desired by the petitioners, the contour of the territory and the volume of traffic being unfavorable.

The Boston Transit Commission gave a public hearing on July 27 upon the relocation of the westerly terminus of the Riverbank Subway. Counsel F. E. Snow, for the Boston Elevated Railway Company, opposed the change on the ground that it would introduce operating difficulties which would be objectionable. The original terminus of the subway was planned near the Charlesgate East, and the present plan is to carry it as far west as the junction of Beacon Street and Commonwealth Avenue.

## New York Commission News.

Owing to the impossibility of having the voluminous forms of contract for the proposed tri-borough subway printed in time, the advertisements for bids were not made last week, and in all probability will not be made until some time in September.

Commissioner Bassett, of the First District, has handed down a decision, for the commission, in which he grants the request of the Coney Island & Brooklyn Railroad to issue $489,539 bonds, par value. This issue is made in order to acquire proceeds to the amount of $391,630, which amount the commissioner decides is justified. The bonds must be sold for not less than 80.

The Public Service Commission, Second District, will give hearings at Albany on Monday, Tuesday and Wednesday of the coming week, at Rochester on Thursday and at Jamestown on Friday. On Monday at Albany the application of the Warwick Valley Light & Power Company for permission to execute a mortgage for $25,000 and to issue an equal amount of 5 per cent 20-year gold bonds will be heard. The Dwass Electric Company, of Schenectady, is required to show cause why the proceeds of the sale of securities authorized by the commission were not expended in accordance with the authorization of the commission. The Lockport Light, Heat & Power Company is required to answer an order to show cause why it should not manufacture and sell gas in conformity with the standard prescribed by the commission, as tests made by inspectors of the commission at various times have shown the gas to be below the candle-power required by law.

On Tuesday the commission will hear the application of the Ithaca-Auburn Power Company for permission to exercise franchises and to commence construction of its lines, and also for permission to execute a mortgage and issue bonds and capital stock.

On Thursday, at the Chamber of Commerce Rooms in Rochester, the commission will hear the application of the Livingston-Niagara Power Company for permission to exercise franchises and construct lines for furnishing electricity for light, heat and power purposes, and for authority to execute a mortgage and issue stock and bonds. At the same time the application of the Livonia Light & Heat Company for permission to exercise franchises granted, the application of the Livonia-Honeoye Electric Light & Railroad Company and the Lima-Honeoye Light Company for consent to transfer and lease of property and franchises and the application of the Lima-Honeoye Light Company for authority to issue capital stock will also be heard. A further hearing will be given on the question of whether or not steam shall be allowed as motive power on the Newark & Marion Railway Company. On Friday, at Jamestown, the commission will give a hearing upon the complaint of the Mayor of Jamestown as to proposed increase in rates for natural gas in that city.

The Public Service Commission, Second District, has authorized the Riverhead Electric Light Company to exercise a franchise granted by the town board of the town of Southampton for the furnishing of electric light for that town. The commission has also authorized this company to issue its five-year 6 per cent bonds to the amount of $5,000, proceeds to be used for the construction and equipping of a distributing line from its station at Riverhead to the village or lighting district of West Hampton Beach. The commission has also authorized this company to issue its seven-year 6 per cent bonds to the amount of $2,300, proceeds to be used for the purpose of purchasing and installing generating machinery and switchboard.

The Newburgh Light, Heat & Power Company has been authorized to purchase an electric lighting plant from Marion Borden Halliday, owned and operated by her in the town of Shawangunk, Ulster County. The commission has also authorized the Newburgh Light, Heat & Power Company to exercise rights and privileges granted by the Town Board and Highway Commissioners of the town of Gardiner, Ulster County; by the Board of Trustees of the village of Montgomery, Orange County; by the superintendent of highways and Town Board of the town of Montgomery, Orange County, and by the Town Board of the town of Shawangunk, Ulster County, for the construction and operation of an electric lighting service in these places. The company is also authorized to begin construction under these franchises and erect a transmission line, capable of carrying 33,000 volts, from Forest Glen, in the town of Gardiner, in a southerly direction to the town of Shawangunk, and through the town of Shawangunk to connect with the distribution lines in that town, then southerly and east of the village of Walden and thence southwesterly to the village of Montgomery and such other distribution lines as will enable the company to distribute and sell electricity in the territory which holds franchises. The same company has been authorized to

issue first mortgage bonds to the amount of $70,500, the proceeds to be used for the construction and equipment of a high-tension electrical transmission line from Forest Glen to Montgomery, a distance of 15 miles, and electrical distributing systems in towns and villages for which they hold franchises.

The commission has approved the transfer by Clarence Mulkins to Carlton A. Graves for the sum of $5,000, of the electrical plant and distributing system in the village of Walton, Delaware County.

The commission has closed upon its records the complaint of the Mayor of Little Falls against the Utica Gas & Electric Company as to the minimum meter charge to energy consumers in Little Falls, price charged consumers of gas in Little Falls, and quality of gas furnished, and as to place of manufacture and method of transmission and distribution of gas. Mayor Timothy Dasey states that a report made by the engineer of the commission is apparently very complete and is carefully and thoroughly made. Upon the report it is apparent that it would be unwise for the city at this time to continue further the investigation and he, therefore, authorizes a discontinuance of the proceedings.

The Public Service Commission of the Second District has received a complaint from Mr. Christopher Deering against the Auburn Light, Heat & Power Company asking that the company be required to furnish electricity for lighting purposes at the complainant's residence in Auburn. The complainant charges that at the time he built his house, about two years ago, the Auburn Light, Heat & Power Company agreed to furnish him with electric energy and upon the strength of the agreement he wired his house for electric light; that since that time he has asked the company repeatedly to furnish the service, but that it has refused to extend its line. An order was issued to the company by the commission on July 26.

The commission has received a complaint from the residents and property owners of the village of Hagaman stating that the 10-cent fare charged by the Fonda, Johnstown & Gloversville Railroad from Hagaman to Amsterdam is unjust and unreasonable and asking that an order be made requiring a 5-cent fare between these points. The complaint has been served upon the company and an answer asked for in 20 days.

The commission has dismissed the complaint of Mr. William S. Lodge against the United Traction Company as to the excess of through as compared with local fares charged between Albany and Troy, the decision holding that under the company's tariff as in force at the time of the hearing on June 1 last the complaint was sustained, but that under the tariff made effective since the hearing the complaint should be dismissed. In disposing of the case the commission announced the following important general rulings:

1. That through rates or fares greater than the sum of local rates or fares to and from an intermediate point are prima facie unlawful and are seldom capable of justification. In this connection reference is made to several decisions of the Interstate Commerce Commission upholding higher interstate charges fixed by two adjoining States. The commission says that such determinations are based plainly upon the view that local conditions or requirements applying in different States, while material upon the question of the reasonableness of a through interstate charge, are not necessarily controlling; that this follows for the same reason that State authority cannot be controlled by a through interstate rate or fare or assignable part thereof in fixing a rate or fare within the State. The two regulating functions are exercised in wholly independent jurisdictions and applied to distinct subject matters.

2. When through fares do exceed the sum of local fares the passenger is entitled to use the local fares by purchase of tickets or payment of cash fares to and from the intermediate point and conforming otherwise to conditions governing the transportation.

3. When a carrier by interurban electric railroad has established a tariff fixing a passenger fare between two points which is greater than the sum of the stated local fares to and from an intermediate point, and provided a regulation in the tariff that the passenger continuing to ride through in the same car must pay the higher through fare, the carrier is required by the law to adhere to its tariff rate and regulation during the time such fare and regulation are permitted to remain in force, and the passenger in exercising any right he may have to combine and use the lower local fares cannot claim the co-operation of the railroad company to the extent of defeating application of the through fare and regulation specified in the published tariff.

# CURRENT NEWS AND NOTES.

**Chicago Electric Club.**—The last regular meeting of the Chicago Electric Club before the summer intermission was held on July 27. Following the annual outing to be given in Ravinia Park on Aug. 6, activities will cease until Sept. 7, when the next regular meeting will be held.

**Removal of Poles and Wires in Chicago.**—On the application of the city electrician, the City Council of Chicago has appropriated $25,000 for the removal of poles and wires from streets and for the construction of conduits for the extension and improvement of the municipal electric street-lighting system. This work is undertaken as a part of the plan by which the Sanitary District will supply 10,000 additional arc lamps for Chicago.

**Fall Meeting, New England Section, N. E. L. A.**—The New England Section of the National Electric Light Association will hold a meeting at The Griswold, Pleasant Point, New London, Conn., on Sept. 13 and 14. There will be a topical discussion on *Rates*, a paper on *The Development of the Electric Sign Business*, a paper on *Special and Decorative Street Lighting*, and one on the *Best General Policy of Central-Station Publicity*. The secretary of the section is Mr. L. D. Gibbs, of the Edison Electric Illuminating Company, Boston.

**Contract Agents Relax Their Cares.**—About 115 men connected with the contract department of the Commonwealth Edison Company, Chicago, attended the annual dinner of the department at the Bismarck Garden, North Clark Street, on the evening of July 19. Mr. E. W. Lloyd, general contract agent, shepherded the flock, and Messrs. L. A. Ferguson, W. L. Abbott, R. L. Elliott and other heads of departments were present as guests. The party filled three special street cars on the journey to the garden, and the evening was spent pleasantly and informally. There were no speeches.

**Wisconsin State Telephone Association.**—The Wisconsin State Telephone Association was organized recently at Madison, Wis., by representatives of a large number of telephone companies in that state. The object of the association is to advance the interests of telephone companies and to oppose the enactment of laws detrimental to the telephone business. It is said to be the policy of the new association to be non-partisan; that is, to further the general telephone operating industry without regard to controversies between Bell and Independent organizations.

**Steam Supply from a Commonwealth Edison Plant.**—The committee on gas, oil and electric light of the City Council of Chicago has recommended that an ordinance be granted to the Illinois Maintenance Company permitting it to supply steam for power and heating from the Commonwealth Edison Company's plant at the southwest corner of Market and Washington streets, to the Hearst Building, at the northeast corner of Market and Madison streets. The proposed steam main is a short one, yet it must cross Market Street, and the permission for laying it is granted in a 20-year ordinance, with a compensation of 3 per cent of the gross receipts to the city, and carefully safeguarded as to change or relocation on the demand of the department of public works of the city.

**Meeting of R. S. A.**—The Railway Signal Association will hold its annual meeting in Richmond, Va., on Oct. 11. The headquarters will be at the Hotel Jefferson.

**Underground Distribution in Sacramento.**—The Sacramento Electric, Gas & Railway Company has almost completed the work of putting its wires underground in the downtown district, and will soon begin removing its poles. Wherever the company can get permission to attach trolley wire supports to buildings it will do so. Where it cannot get this permission it will erect iron poles and remove the old wooden ones. The ordinance requiring all companies owning poles and wires to put their wires underground in the business district was passed by the trustees some months ago, and is being complied with by all companies.

**Telephones in Engine-Rooms.**—The attention of the city authorities of Los Angeles has been called to the alleged fact that the new telephone ordinance does not provide for rates to be charged for telephones placed in engine-rooms of office buildings or other buildings. It is contended that these telephones can be classified neither as business nor residence telephones, and it has been suggested that this particular service be placed under the head of "business telephones unclassified," for which the companies have been charging $3 a month. Complaint is made that $5 a month has been charged for engine-room telephones.

**Electric Smelting in California.**—Reports from the electric smelter at Héroult, near Redding, Cal., are to the effect that the smelter has been in operation since the middle of July. The output is said to be 20 tons of pig iron a day, and the plant has been operated with entire satisfaction so far. A party of iron-masters and others from San Francisco recently inspected the electric smelter and pronounced the demonstration a success. It is said that iron is made at a cost of $12 a ton, and that it is worth $30 a ton on the Pacific Coast. It is reported that nearly $300,000 has been spent in perfecting the installation, and it is now regarded that the period of experimentation has passed, and it is said that five additional furnaces will soon be built.

**The Electrotherm and the Summer Girl.**—It is interesting to observe that the electrotherm has received recognition in the "Health and Beauty" corner of the daily papers. A recent writer of notes of this description says: "The girl who will travel this summer should take with her an electric heating pad. This is light and soft, with a covering of muslin and another of eiderdown. It will heat in about 15 minutes and can be so manipulated that it keeps at any given heat. Why bother with a hot-water bottle, steamed flannels, baked bricks, hot boxes or any of the old methods for applying heat to the body when you can have an electric pad that can even be used as a foot-warmer in the automobile in a pinch?" The last statement would seem to indicate a recommendation of the electric automobile as well as the heating pad.

**Colorado Convention.**—The Colorado Electric Light, Power and Railway Association has sent out its first announcement for the 1910 convention, which is to be held at Hotel Colorado, Glenwood Springs, Sept. 21 to 23, 1910. It is announced that papers will be printed in advance to afford an opportunity for discussion. Papers are promised on the following subjects: "High and Low-Tension Pole Lines," "High and Low-Pressure Steam Turbines," "Non-Synchronous and Synchronous Motors." The committees on "Grounding Secondaries," "Insurance," and "Meters" will report. As usual, the Question Box will be a prominent feature. The Sons of Jove promise an enlivening entertainment during the meeting. The hotel rates, American plan, are $4 per day for room without bath and $5 per day for room with bath. Mr. J. C. Lawler having left the State, Mr. F. D. Morris, 323 Hagerman Building, Colorado Springs, is acting as secretary.

**Irrigation Water for Hydroelectric Energy in Utah.**—One of the most important irrigation systems in the State of Utah is the Davis and Weber counties canal, which is 17 miles long and carries a maximum of 750 cu. ft. of water per second. It serves at present more than 500 fruit orchards and farms in the counties indicated. The canal is diverted from the Weber River at the mouth of the Weber Canyon and is carried along the side of a stretch of hills overlooking the Uintah Valley. At a certain point on the canal, 4 miles from the mouth of the canyon, there exists a sheer drop of 220 ft. to the valley below. This head will be utilized in conjunction with a hydroelectric power station in the valley, the discharge to be returned to the Weber River. The maximum power available is, approximately, 15,000 hp. The initial installation will be designed to develop about 6000 hp. The consulting engineer for the hydroelectric installation is Mr. H. A. Strauss, of Chicago.

**Proposed Engineering Societies Building for Chicago.**—Men engaged in engineering and technical pursuits in Chicago have not viewed the success of the Engineering Societies Building in New York and the proposed erection of a similar structure in Boston without hoping that the time is not far distant when Chicago will have like facilities. The subject was brought up at the meeting of the Electric Club of Chicago on July 27 by Mr. C. A. S. Howlett, former president of the club, who called attention to the situation and said that, owing to the number of technical societies in Chicago meeting in various places, there is a real need for such a building. Mr. Howlett suggested that in the fall the matter be taken up by the club. The Western Society of Engineers is the principal local engineering society of Chicago, and several years ago the subject of erecting an engineering building was discussed quite energetically among the members of that society. Nothing came of the discussion, however, and since then the society has moved into larger quarters, under a lease that will not expire until 1918. Many of the technical men of Chicago feel, however, that the various professions and industries represented have reached a stage in their career which should be marked by the dignity of an engineering building, and it is possible that a determined effort to bring about the erection of such a building will be begun before long.

**The Ever-Present Electromagnetic Gun.**—A recent issue of a London paper contains an inspiring account of the results to be expected from the electromagnetic gun, a recent model of which is described as follows: "It consists of a plain brass tube, open at each end. Over the tube a number of coils of copper wire are placed, the wire being wound on bobbins and the coils slipped on separately with the end of each coil projecting from the end of the bobbin. One set of ends of these coils, of similar polarity, are fastened together and led to a switchboard, where they are attached to a metallic brush. The other ends are separately led to the switchboard, each being fastened to adjacent pieces of contact metal lying flat on the board. In the circuit at a convenient point is the source of the electric current. If the metallic brush be now rapidly drawn across the face of the metallic segments, increasing in speed as it goes, the current is passed through each of the successive coils at a correspondingly increased speed. The shot, which is of cast iron, and fits easily into the tube, is inserted at the lower end. It is at once drawn forward by the first coil, then caught up by the second, and so on, advancing toward the muzzle at an ever-increasing speed until it leaves the barrel and starts on its deadly errand." The writer mentions the "absurdly small cost" and simple equipment for a gun capable of firing a 132-lb. shot at a muzzle velocity of 4450 ft. per second. He seems to have ignored the energy stored in the shell, which equals 40,000,000 ft.-lb., or 70,000 hp-seconds. Unless more than 70,000 hp were used in "firing" the gun, its length would have to be more than 2225 ft. The principles of mechanics and magnetism involved in the electromagnetic gun were discussed in our issues for Dec. 5 and 26, 1908, and Jan. 7, 1909.

**Electric Cranes for Italy.**—The Italian Minister of Public Works has authorized the expenditure of $86,000 on the supply and construction of electric cranes for docks on the River Tiber.

**Wireless Telegraphy Between London Universities.**—Prof. J. A. Fleming, at the University College, and Prof. E. Wilson, at King's College, London, have established wireless telegraph stations for communication between these institutions. Instruction is given at each place in the principles and practice of radio-telegraphy.

**Brilliancy of Electric Light.**—A Denver paper records the fact that during the recent passage of Halley's comet the city lights were turned off for a short period one evening to enable the people to see the wanderer in the sky. So brilliant are the lamps, it is contended that had not their rivalry been withdrawn it would have been difficult or perhaps impossible to see the comet.

**Increased Membership in A. S. I. R. A.**—At the forthcoming annual convention of the American Street and Interurban Railway Association, to be held at Atlantic City from Oct. 10 to 14, it is expected that the association will represent 100 more electric railway companies than in 1908, the total being about 360. The associate membership enrollment at present exceeds 1050, as compared with 249 in 1908.

**Iron Pipes for Telephone Poles.**—In constructing a telephone line along the Panama Railway Company's system use will be made of poles consisting of 2-in. galvanized-iron pipe standing 15 ft. out of the ground, each pole being equipped with one 6-pin, 6-ft. cross-arm. At first there will be erected telephone circuits, each consisting of two No. 10 copper wires, the extra two pins being provided for future extensions.

**Award for Water Power Diversion.**—The Croton Falls Electric Light Plant, of which George Juengst & Sons are the owners, has been awarded $118,732 for the diversion of 30,000,000 gal. of water daily for reservoir K of the Croton Dam in the New York City watershed. The Croton Falls Electric Plant at present supplies energy to Croton Falls, Brewster, Purdys, Somers, Goldenbridge and Katonah, N. Y.

**Mr. Insull's N. E. L. A. Address.**—Owing to the demand for the full text of the address on "Twenty-five Years of Central-Station Commercial Development," delivered by Mr. Samuel Insull at the St. Louis convention of the National Electric Light Association on May 25, 1910, the *Edison Round Table*, which is the organ of the Commonwealth Edison Branch of the N. E. L. A., with office at 139 Adams Street, Chicago, has reprinted the address in pamphlet form.

**Wireless Telephony Civil Service Position.**—On August 24 the United States Civil Service Commission will hold examinations throughout the country for those who are versed in the science of wireless telephony. All vacancies in the Government service requiring such qualifications will be filled from the list of competents thus secured. A position of "assistant in wireless telephony for the signal service at large," paying $1,080 per annum, is now open, and an appointment will be made from those who pass the August examination, which will consist largely of theoretical and practical questions in electrical engineering, with especial attention to wireless telephony.

**Electricity for Mining in Canada.**—The Temiskaming and Northern Ontario Railway Commission, in its report on mining and water-power developments in the Cobalt mining district of New Ontario, Canada, states that on the Metabitchouan River, about 2 miles from the Montreal River landing on Lake Temiskaming, the Mines Power Company is installing four hydroelectric generating units capable of developing in all 10,000 hp. This company is building a dam 860 ft. long at a height of 50 ft., which will give a working head of 312 ft. Each unit consists of a 2750-hp turbine directly connected to an electric generator. This plant is nearly 25 miles from Cobalt, and will need four substations, with transformers, for distribution of the energy.

**Shortage of Water.**—Hydroelectric installation in various sections of the country are experiencing difficulty in keeping their turbines running on account of the summer drought. The Connecticut River has decreased its flow to such an extent that the Connecticut River Transmission Company has been unable to deliver energy to all of its customers and several are using steam-engine equipments to supply the deficiency during the drought. At Minneapolis the Twin City Rapid Transit Company has received effective aid from the Minneapolis General Electric Company and the Pillsbury Flour Mills Company. The latter company closed its mill "A," said to be the largest in the world, in order that its water-power could be used by the Rapid Transit company during the low-water period.

**Peat Possibilities.**—The possibility of utilizing the peat deposits of the United States for fuel is attracting increased attention. A recent writer says that a good tract of peat of 28 acres in exent and averaging 9 ft. in depth, on proper treatment, should yield 50,000 tons of peat fuel, or enough to support a community of 100 families for 35 years, if the average consumption of each family were as much as 20 tons a year. It is also computed that the same peat deposit would furnish a manufacturing or electric lighting plant of 100 hp fuel for more than 40 years, allowing 300 10-hour days to the year and 8 lb. of fuel for each horse-power developed. If it were practical to use the peat in gas producers, it is estimated that the supply from the 28 acres would last the 100-hp plant for nearly 100 years, under the conditions named. The report of the American Peat Society, which was held at Ottawa, Ont., is printed on another page.

**Electricity Directly from the Coal Mines in Texas.**—In the center of a coal field at a point about 36 miles above Laredo, Tex., on the Rio Grande, a syndicate headed by Mr. H. A. Stucky proposes to erect a generating station, the fuel for which will be coal screenings. The energy will be transmitted to Laredo, Carrizo Springs and Cotulla, in Texas, and to a number of places in Mexico, including Monterey and Lampazos. The Uvalde & Crystal City Railroad, which is now operated by steam between Uvalde and Carrizo Springs, is to be extended to the coal fields, where the power plant will be located, and will be converted to electric traction, energy to be furnished by the proposed plant. The extension of this road will be about 35 miles long, making in all about 110 miles of track that will be operated electrically. It is expected that energy will be furnished for irrigation pumping on both sides of the Rio Grande for a distance of 100 miles along that stream. The initial equipment of the plant will be rated at 50,000 hp.

**Cleveland Electrical League.**—More than 250 people attended the first annual outing and chicken dinner of the Electric League of Cleveland, Ohio, at Willoughbeach Park, on Lake Erie, on July 30. On account of overlooking the necessity of securing a permit, the baseball game between the Mazda team and Fagan's Tigers had to be omitted, two other teams having secured the desired paper. This was one of the special features, but other events took the place of it and the electric people got along famously without it. The league, which was organized for the promotion and development of the local electrical market, glories in the slogan: "All Together, All the Time, for Everything Electrical." The officers are as follows: President, Mr. G. E. Miller, Cleveland manager of the Westinghouse Company; vice-president, Mr. E. E. Noble, superintendent of construction of the Cleveland Electric Illuminating Company; secretary, Mr. H. H. Cudmore, president the Brilliant Electric Company. The committee in charge of the outing consisted of Messrs. G. S. Milner, chairman; G. E. Miller, E. E. Noble and J. R. Crouse.

## COMBINATION ELECTRIC LIGHT, WATER AND ICE PLANT.

### Successful Operation of the Loveland Citizens Electric Company in a Town of 3,000 Inhabitants.

LOVELAND, Ohio, is a town of about 3000 inhabitants located on the Little Miami River, 23 miles from Cincinnati, on the main lines of the Baltimore & Ohio Southwestern and the Pennsylvania Railroads. By reason of its natural advantages, railroad facilities and public utilities, it is expected that the town will grow phenomenally within the next few years. The electric light plant and water-works have been designed with this rapid growth in view and are capable of rendering service to a greatly increased population without being rebuilt or remodeled from year to year to meet these demands.

The Loveland Citizens Electric Company owns and operates the electric-light and water systems and also an ice-making plant. From its office in the power-plant building these three enterprises are conducted by a single office force and head. The water for the city is obtained from a deep well on an island 2600 ft. from the station. By the use of a vertical centrifugal pump direct-connected to a vertical motor the water is delivered to the pumping station into a container located under the large pumps (Fig. 4). The storage tank is made of cement and holds about 45,000 gal. From this tank the water is taken by the pumps shown and delivered into a tank located 1200 ft. from the power station under a pressure of from 105 lb. to 120 lb. This water tank holds 120,000 gal. and from it the town receives its supply.

The boiler-room in the power station contains two 200-hp water-tube boilers, either of which can carry the load on the station. Water is fed to the boilers by two duplex pumps interconnected so that either one can supply one or both boilers. The latter are connected to the stack through breaching with an "S" bend to reduce friction of gas in the stack as much as possible. The fuel is dumped from the car into a track hopper, whence it is conveyed by an elevator at nominal expense to the storage room. Before the installation of this elevator the cost of unloading a car of coal approximated $10, owing to the disadvantages under which the work was performed. An ordinary hopper-bottom car can now be unloaded at an expense of about $2. A weighing device is arranged to weigh the coal as delivered to the boilers and a record is kept of the amount; the water is measured in a settling basin, so that the management knows how much water is being evaporated with a given amount of coal.

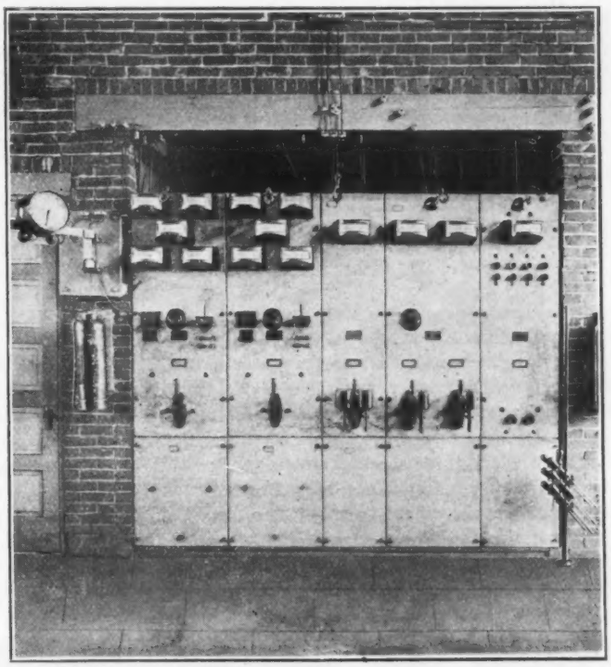

Fig. 2—Switchboard.

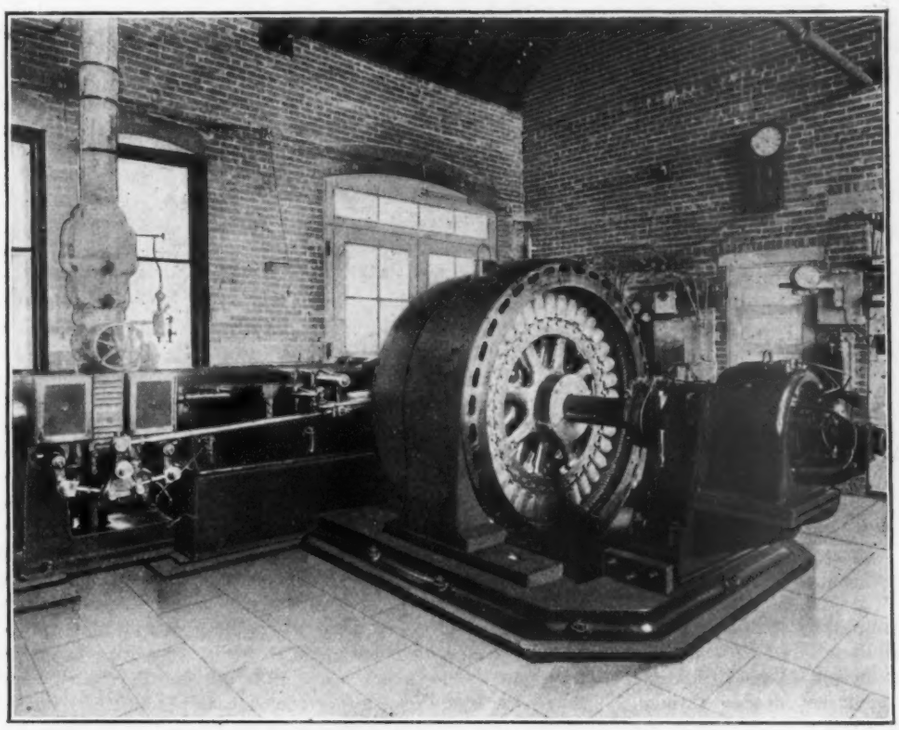

Fig. 1—One of the Generating Units in the Loveland Station.

The company has installed a home-made water softener comprising two tanks 10 ft. in diameter by 8 ft. deep. Each tank holds about 4700 gal. of water, which automatically flows into it and automatically ceases flowing.

To every 10 gal. of water are added 13 grains of soda ash and 134 grains of lime. The water is then agitated by revolving paddles having a number of ½-in. holes bored in them. The paddles are fastened to a piece of shafting set in the center of the tank, the bottom of the shaft resting in a socket. To the top of the shaft is attached a small, grooved belt-wheel from which a belt connects to a countershaft. After the water is agitated about 30 minutes and subjected to heat from a coil of pipes extending around the inside of the tank, it is allowed to settle for four or five hours. The coil of pipe is heated with exhaust steam and the heat is sufficient to augment the chemical treatment of the water.

After the water has remained in a quiet state for four or five hours, the valve to the feed-water heater is opened and the water thus treated flows through an iron tube or filter 20 in. in diameter, 6 ft. of its length is filled with hay, 6 ft. with excelsior and 4 ft. with charcoal. The water is removed from

the tank by a siphon. The bottom of the tank is fitted with a blow-off through which all solids are washed when the tank is empty. While one tank is being emptied the other is being filled and treated, and the cycle is continued with most flattering results. The treated water showed the following impurities on analysis:

ANALYSIS OF WATER.

| Impurities | Parts per Million |
|---|---|
| Turbidity | Trace |
| Sediment | Trace |
| Odor | None |
| Oxygen required | .5 |
| Nitrogen as free ammonia | .02 |
| " " albuminoid ammonia | .056 |
| " " nitrites | Trace |
| " " nitrates | 1. |
| Chlorine as chlorides | 9.5 |
| Alkalinity | 94. |
| Incrustants | 22. |
| Iron | None |
| Total solids | 200. |
| Number of bacteria to cc | 50. |
| Colon bacilli | None |

Before the installation of the water softener the boilers had to be cleaned at least every three weeks. At the present time the boilers are cleaned every three or four months, and at the end of that time are in much better condition than they were when cleaned every three weeks. Moreover, great savings are made in fuel, boiler maintenance, etc. Besides coping with the water problem, the Loveland company is working on the problem of heating the air before it is delivered under the grates of the boilers, hoping in this way greatly to improve the economy.

The steam pipes furnishing steam to the engines are so arranged that one engine will not be affected by the steam of the other engine, and the pipes are carefully covered with asbestos magnesia to render the service more efficient. The exhaust line is equipped with an oil separator of large capacity through which the steam passes, and is arranged with a by-pass to the feed-water heater and purifier. By means of a valve the flow of exhaust steam and water to the heater can at all times be easily and correctly regulated. At the head of the exhaust-steam by-pass there is installed an automatic back-pressure valve designed to pass exhaust steam from the power plant to the ice-making plant, 70 ft. away.

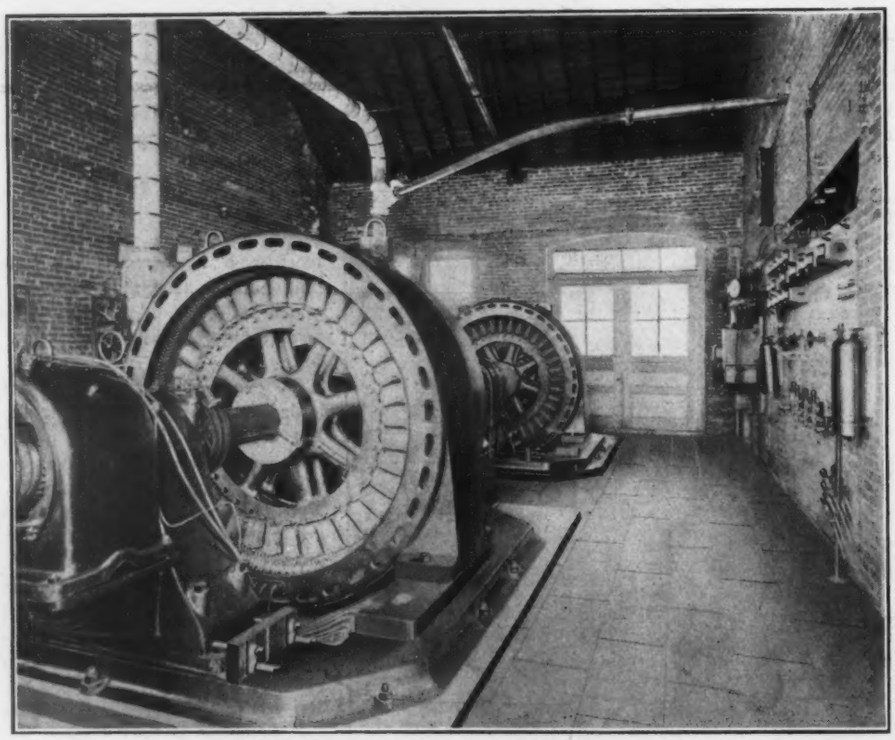

Fig. 3—General View of Generator Room.

The engine room contains two four-valve engines which have been in operation approximately four years. The total expense for repairs on these engines during that time was $8.40, and $100 covers the amount expended for repairs on the generators and exciters. The engines are direct-connected to 125-kw revolving-field, three-phase, 2200-volt, 60-cycle alternators. The exciters are direct-connected on the extended shaft, which is so arranged that the bearings can always be adjusted to the shaft to keep it in alignment in case of wear.

Each machine has for its operation and control a panel on the switchboard, which is equipped with horizontal instruments, necessary switches, etc. The incandescent lighting service for the town is divided into two circuits, known as the East Loveland and the West Loveland circuits, so that if anything should happen to interfere with the service of one part of the town the other section need not be disturbed. Besides, there are junction boxes on poles at fixed points over both East and West Loveland for isolating troubles, so that the switches at the station are used only in emergency. The arc lamp service consists of series arc lamps on two independent circuits.

The management has induced every user of steam engines in Loveland to cease using engines as prime movers and to use electric motors instead. In every instance where engines have been displaced by electric motors the change was accompanied by a saving to the user as well as a profit to the central station. In five years' operation there has not been more than one outage, and that was occasioned at the instance of the Mayor of Loveland when an iron flagpole was blown over and rested on the electric light feed wires. Much trouble was experienced at first in the operation of the water plant in maintaining the service boxes. The old type of box would become so displaced that the key could not be put on the service cock to shut off the water and the lids would also break off. A new type of water-service box has been installed with excellent results.

The ice plant, which is operated in conjunction with the lighting and water plants, has much of interest. One of the purposes of the management has been to give its patrons an all-day and all-night electric service. Consequently, the electric light plant was operated much of the time on a very light load and with poor efficiency. The installation of an ice plant was therefore of much assistance to the electric light plant.

The ice plant consists of a compressor room, freezing tank, flat cooler, storage tank room, ice dump, from which ice is passed through a chute to an ante-room, whence it may be loaded on wagons from the platform or placed in an ice storage room. Under the latter room there is another room which can be used for cold storage purposes or for storing ice. Over the ice storage room proper are built fruit storage rooms, meat storage rooms and egg storage rooms, each room being so piped that the correct temperature can be maintained at all times for the proper storing of perishable goods. Great care was manifested in the selection of all building material and machinery and the installation was made symmetrical. Water is pumped with a 2-hp motor direct-connected to an American, horizontal, centrifugal pump, the discharge of which passes over the ammonia condenser, whence it flows over the steam condenser and

then to the sewer. The never-failing supply of cool water makes the latter plan quite feasible and economical. The efficiency of the system due to the cooler water acting on the gas in the ammonia coils is enhanced, the operation of the plant is more regular, and the energy required by the compressor is less than is required by most compressors when warmer water is flowing over the ammonia condenser.

During the past season the plant took care of approximately 20,000 cu. ft. of refrigeration, besides manufacturing 15 tons of ice daily.

Ice plants in cities of less than 75,000 inhabitants in the

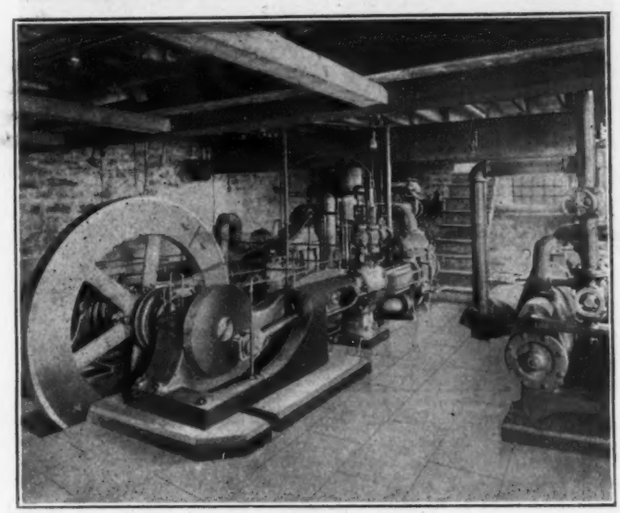

Fig. 4—View of Pump Room.

northern and central states cannot often be operated, for want of market, longer than six or seven months. Besides this disadvantage, in order to take care of the trade it is frequently necessary to deliver ice in such small quantities as to represent a direct loss. Ice must therefore be kept in storage, and unless the temperature is kept at 32 deg. Fahr. or lower it will shrink rapidly. To store ice at this temperature it is necessary at times to operate the compressor at least two or three hours in every twenty-four. This operation can be regarded as a direct loss, but every business has its disadvantages as well as its advantages.

The management of the company at Loveland maintains that success in the ice business is attained only by the exercise of great attention, and the storage of large quantities of ice in preference to maintaining a plant of large capacity. This enables the plant to be operated continuously and overcomes the very objectionable feature of having to operate the plant for only a few days at a time, or a few hours each day. Unless the plant is operated continuously, the correct temperatures of the storage rooms cannot be easily maintained. This is of extreme importance, if success is to attend the storage of fruit, vegetables, etc. When, as often happens, a large quantity of fruit or other product is placed in storage rooms for about a week, and then a portion of it is removed, the cold storage rooms are left almost vacant and it is necessary that the temperature of the storage rooms should be accurate for the lesser quantity as for the larger quantity. Were the ice-making plant not operated continuously, the cost of maintaining the cold storage of fruits, vegetables, etc., would be prohibitive.

In a room adjoining the office in the power house a large assortment of electric and plumbing material is kept in stock in order to enable quick installations to be made. This is a matter of importance, since it often leads to the acquisition of a new customer for electricity or water or both. When the right type of man is detailed on the job he can usually show the customer that it is to his advantage to install both electricity and water. At the same time he may find a householder who should have a refrigerator and thus secure a customer for ice. The refrigerators are sold at cost plus $1 to cover the expense of handling, and electricity and water are installed practically at cost.

Based on its experience, the company emphasizes the importance of having sufficient ice storage to take care of the capacity of the plant, so that it may be operated continuously. Unfortunately, figures are not available for publication showing the cost price of the manufacture of ice by the Loveland plant; but it is said to be sufficiently low to be attractive. A patent has recently been granted one of the directors of the ice company for a process by which ice is made from raw water without distillation.

## CENTRAL STATION ICE MAKING.

### Equipment for Making Ice in Connection with Electric Energy.

THE combination of the electric service business with that of ice making in small towns is one that is beginning to receive increased attention. The plant installed last summer by the Sterling Consolidated Electric Company, of Sterling, Col., is a good example of what may be accomplished by such combinations.

The town of Sterling is located on the South Platte River, and is in an agricultural and stock-raising community. The conditions limiting the design of the plant were to provide apparatus for an existing population of 4000 and space, as far as practicable, for additional apparatus to accommodate a probable growth to 8000. At the same time a limit was placed upon the amount of money to be expended.

The boiler plant consists of two horizontal, water-tube type units each of 177-hp rating, with space for a third. These are equipped with induced draft apparatus, and are hand fired. The coal bins are outside the boiler room, and are closed off from the boiler room, excepting for the necessary openings in front of each boiler through which the coal enters by gravity. This arrangement prevents in a large degree the dust due to coal handling in the boiler room. Coal is shoveled into the bins directly from the car. The induced-draft equipment consists of two fans, each of sufficient size to operate the plant, and each driven by a directly connected vertical engine the speed of which is automatically controlled by the steam pressure. In cases of emergency both fans can be used to operate the boilers at an overload. The initial cost of the induced-draft apparatus was less than that of a stack for equal

Fig. 1—View of Station Building Showing Storage Tank and Miniature Chimney.

service, while the cost of operation is more than offset by the absolute control given over the draft.

There are two generators, each directly connected to a horizontal engine of the high-speed type. The smaller unit is of 75-kw rating, with a simple engine. The larger is of 150-kw rating, with a compound engine. Each generator has its individual exciter, placed near the cylinder of the engine and belt driven from the main wheel of the engine, this arrangement being economical of space. The smaller unit is now used to take care of the day load, which it was estimated would never be large, there being little opportunity for a large motor load. There is space left within the present building for a

third unit, of 150-kw rating, or for a larger unit of the turbine type should it be decided to operate condensing.

The energy is generated as three-phase, 60-cycle current, at 2200 volts, which is distributed single-phase for lighting and small motors, and three-phase for large motors. The street lighting is taken care of by a 35-lamp series enclosed arc system operated on a moonlight schedule. The switchboard is of blue Vermont marble, consisting of six panels; two of these with the usual complement of instruments are for the control of the two generators, one for arc apparatus, two for single-phase service, and one for three-phase service. At present the single-phase load is divided between two of the phases, while the arc load is on the other. By this means the voltage on the incandescent lamps can be kept uniform. Phase regulation is contemplated, but has not as yet been found necessary.

The ice-making plant has a rated output of ten tons of ice, 20-ton refrigerating, in 24 hours, cold storage not considered. There is one ammonia compressor, with space for a second. The compressor is driven by a directly connected Corliss engine. The freezing system is that known as the Vaile, in which the tank is divided into a number of sections each of which has its own circulating system, by which it is possible to repair any one section without interfering with the operation of the other sections. They are 300-lb. cans, and the time of freezing is 48 hours. The cans are handled by a hand-operated crane. Each section of the freezing discharges its warm brine into a common receptacle from which the circulating pump draws its supply. The ammonia condenser and brine cooler are of the standard double-pipe type; the brine cooler is located in the ice storage room. The storage room has a volume of 5000 cu. ft., which has been found to be ample. The can-dump floor of the storage room and the loading platform are on the same level, so that the lifting of the ice is reduced to a minimum. The thermal insulation of the ice plant is of cork throughout; in the storage room this is covered with cement on the side walls and concrete, cement finished, on the floor.

The exhaust steam of the entire plant passes through the feed-water heater, which is also equipped with an oil separator, and thence to condensing coils on the roof of the building. The distilled water thus obtained, after reboiling to expel the

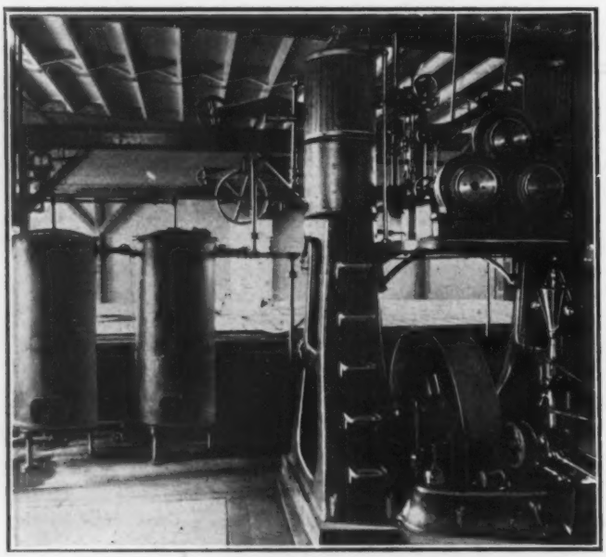

Fig. 2—Ice Making Machinery.

air, is filtered and then passes to the supply tank, where it is partially cooled by the brine returning from the refrigerating tank. This forms the supply for ice-making, and results in pure, clear ice, free from bubbles.

The water supply for the plant is obtained from two wells, one of which is about 600 ft. deep and the other about 60 ft. There is also a connection to the city mains for reserve.

In operating the ice plant it has not been found economical to store ice for any considerable length of time. The storage room, therefore, is only large enough to equalize the supply to the demand, the maximum demand for any one day being somewhat over two carloads.

In connection with the lighting and other business the company has carried on a coal business in rather a novel way. Mine-run coal is purchased, on which a favorable price and freight rate are obtained. When this is shoveled from the car

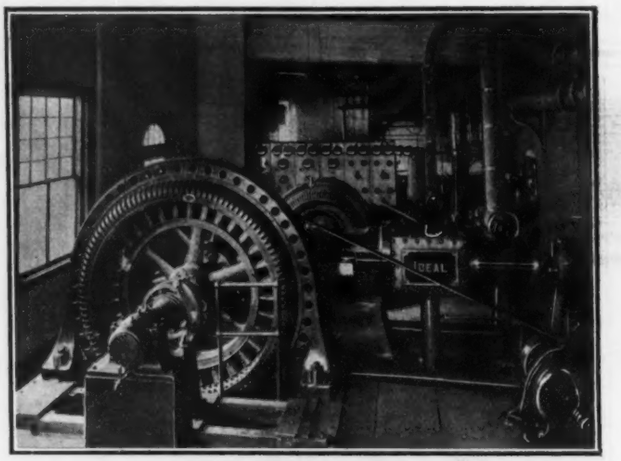


Fig. 3—Electric Generating Equipment.

the larger lumps are separated and sold for domestic use, rated as lump coal, while the slack and smaller lumps are separated and used to operate the plant. By this means the company can always supply its customers with a clean, good product with no small coal except that due to handling and cartage from the retail bins.

The plant was started during the latter part of last year's ice season. The ice plant was not run a sufficient length of time to get it well systematized, but all indications point to the fulfillment of all that was expected of it in connection with the electric service business. The ice business is best at a time when the lighting is at its poorest. The ice plant can be pushed during that part of the day's run when the lighting load is least, and during the heaviest demand for ice one additional man to the operating force is all that can be charged to that part of the business. The total combination, including the coal business, makes one that has already proved satisfactory and one that should find favor in many small towns similarly situated.

## ELECTRICITY FOR FACTORIES AT KOKOMO, IND.

### The Electrical Distribution System of the Kokomo, Marion & Western Traction Co.

THE generating station of the Kokomo, Marion & Western Traction Company, at Kokomo, Ind., produces electrical energy for the operation of an interurban railway between Kokomo and Marion, 28 miles, and for lighting and power purposes in Kokomo, Greentown, Swayzee and Converse. A feature of the business of the company has been the very large growth in the motor and lighting demand during the past few years, following the adoption of aggressive methods for developing and securing new business. Nor will the management be content, to quote an official of the company, until the Kokomo power house "turns every wheel in Howard County."

In 1904 the local lighting business in Kokomo was divided among 290 consumers, out of the city's population of 15,000. Two years later this number had been increased to 800 customers, and now in 1910 the company has 1600 meters on its lines in Kokomo, with the present population of 18,000, not including the 100 customers in Greentown and 50 in Swayzee.

In the meantime the motor load has grown to a total connected rating of 1400 hp. During the period from 1902 to the present time the total annual earnings from the lighting department have increased from $13,000 to approximately $105,000 for 1910. It is now also likely that the interurban line will be extended westward to Frankfort and eventually to Terre Haute.

The generating station of the Kokomo, Marion & Western Traction Company is a modern brick structure, 100 ft. x 120 ft.,

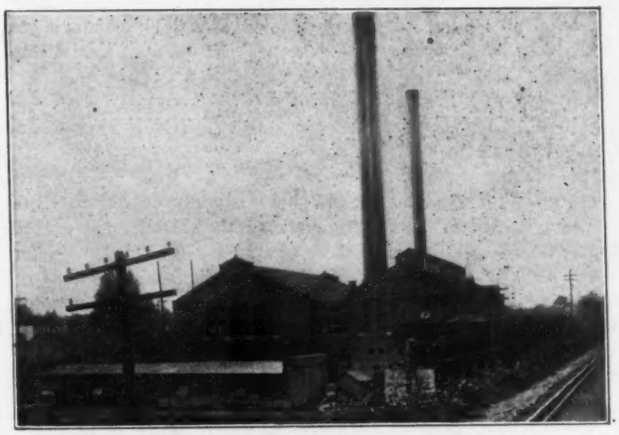

Fig. 1—Generating Station of Kokomo, Marion & Western Traction Co., Kokomo.

with railway siding connection to the tracks of the Lake Erie & Western Railroad. The plant equipment comprises two 1000-kw Allis-Chalmers steam turbines driving 1000-kw, 2300-volt, 60-cycle, two-phase alternators at 1800 r.p.m., and a 550-hp Russell engine driving a 400-kw, 2300-volt, 60 cycle, two-phase alternator at 165 r.p.m. The last unit is held in reserve for standby service. Two exciters of 30 kw and 35 kw rating, respectively, are provided, one engine driven and the other operated by an induction motor.

The boiler equipment comprises four of the 235-hp Stirling type, one 407-hp Stirling and one 400-hp Atlas. Coal is handled by shoveling from the piles opposite the fire doors, where it is discharged from cars brought in on a railroad siding on a steel trestle, which extends the length of the fireroom and further to a storage yard north of the boiler house. After the unsuccessful trial of a screw ash conveyor, the ashes are now raked by hand from the furnace pits, and conveyed in small cars to an elevated ash bin outside the building. The furnaces discharge their flue gases into three stacks, two approximately 125 ft. high and the third 110 ft. high. Water for condenser and boiler feed purposes is derived from a nearby creek, supplemented by the supply from a deep well delivered by a 4-in. motor-driven centrifugal pump. The feed-water and boiler pumps are in duplicate.

The present station output to the various railway, lighting and motor loads does not exceed the rating of one of the turbine units, so the plant works at the advantage of having a

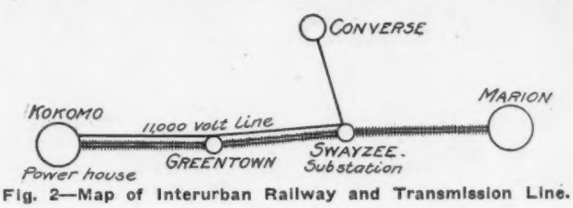


Fig. 2—Map of Interurban Railway and Transmission Line.

duplicate equipment in reserve. This argument has been found a potent one in going after motor business, and the policy of maintaining a spare unit will be adhered to when the present equipment becomes fully loaded, by adding another machine.

Sixty-cycle, two-phase energy, generated at the alternators at 2300 volts, is stepped up to 11,000 volts and converted into three-phase by the T-connected bank of 150-kw station transformers, for transmission to the substation at Swayzee, which feeds the interurban trolley and the distribution lines to neighboring towns. The 11,000-volt transmission from Kokomo to Swayzee is brought along the tops of the poles carrying the side-arm trolley suspension for the interurban railway. The Swayzee substation, which occupies a building with the interurban ticket office and waiting room, contains one 200-kw and two 75-kw rotary converters. The 550-volt, direct-current energy for operating the Kokomo street-railway system and for feeding into the Kokomo end of the interurban trolley is regenerated on the main power-house turbine-room floor by two 216-hp motor-generator sets, whose driving elements are energized from the 2300-volt, two-phase generator buses.

Two storage batteries are provided for reserve in feeding the 550-volt railway lines, one at the Swayzee substation, with a discharge capacity of 320 amp-hours, and the other in a small one-story battery house adjacent to the main power station at Kokomo, and having a discharge capacity of 480 amp-hours. These batteries are continuously floated on the trolley feeders and serve to assist in smoothing out the characteristic fluctuations of the railway load. The feeder wires are of 300,000-circ. mil and 500,000-circ. mil cable. The interurban rolling stock comprises six passenger cars each equipped with four 60-hp motors and several freight and work cars. The hourly schedule calls for simultaneous operation of three of these. The 22 city cars are fitted with two 40-hp motors, and run on 10-minute schedules over the city lines.

Of the 5,000,000 kw-hours produced annually at the Kokomo generating station approximately half goes to operate the electric railway systems, the interurban requiring about 1,800,000 kw-hours and the local car lines 620,000 kw-hours last year. The demand of the 1400 hp in motors installed in the 100 or more Kokomo factories and shops aggregates almost 1,000,000 kw-hours yearly. The commercial lighting, a feature of which is the store and sign business, consumed 715,000 kw-hours in 1909, and the lighting of residences required 210,000 kw-hours. The company also supplies 460,000 kw-hours yearly to 225 street arcs, all but 20 of which are in Kokomo.

The Kokomo, Marion & Western Traction Company sells electricity for lighting and power according to the following rates:

Commercial lighting, 10 cents per kw-hour; $1 minimum monthly. Discounts for payment of bill within five days from 5 per cent to 25 per cent, depending on size of bill. Long-hour

Fig. 3—Engine Room in Power Plant of Kokomo, Marion and Western Traction Co., Kokomo.

users guaranteeing 40 hours' use of entire installation per month are given a 10-cent rate for the first block of consumption and 5 cents per kw-hour for all used additional. Cash discounts on 10-cent portion of bill.

Residence lighting, 12 cents per kw-hour; $1 monthly minimum; discount, 10 per cent for payment within five days.

Energy for motors, 5 cents per kw-hour. Minimum, $1 per connected horse-power of motors. Discount, from 20 per cent

to 40 per cent for prompt payment, rate of discount depending on size of monthly bill. Under this rate the customer agrees not to use energy during the hours of peak lighting load.

In addition to the above, flat rates of a fixed sum per season are offered for operating fans purchased by the customer. Twelve-in. fans, $6 per season; 16-in. fans, $8 per season; ceiling fans, $12 per season, payable in two payments, one on installation and the second July 1.

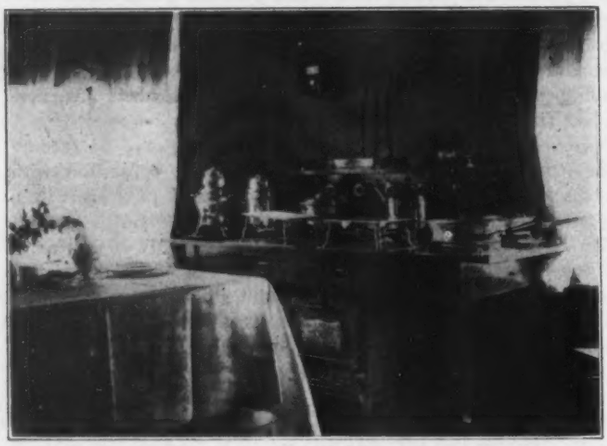

Fig. 4—Electric Kitchen in Private Residence, Kokomo.

The competitive natural gas rate, for both domestic and manufacturing purposes, is 25 cents per 1000 cu. ft.

The revenue from the various classes of energy-supply business in Kokomo for the first five months in 1910 as compared with the same months in 1909 was itemized as follows:

REVENUE FROM DIFFERENT LOADS.

| | 5 Mo., 1910 | 5 Mo., 1909 |
|---|---|---|
| Street Lighting | $5,791.70 | $5,511.70 |
| Commercial Lighting | 16,072.49 | 14,777.20 |
| Residence Lighting | 10,187.46 | 8,358.30 |
| Motor Circuits | 11,132.06 | 4,883.72 |
| Miscellaneous Lighting | 101.72 | 65.32 |
| | $43,285.43 | $33,596.24 |

The majority of the services are metered, although a few flat rates remain in the system. For sign lighting and for the halls of buildings where lighting is furnished to offices and tenants a flat rate is made, based on a charge of 1½ cents per watt per month.

About 600 electric irons are in use in Kokomo. The electric company sells these to customers at nearly cost, in order to enjoy the income from having these energy-consuming devices on its lines. To the same end, minor repairs on electric irons are made free of charge. An electric iron has also proved an attractive prize when offered free to those new customers who have their lighting installations connected up during a given month. This program of giving away an iron to each new consumer is carried out usually during one month of each year, and is generally the means of placing about 60 to 70 irons and hastening in as many new customers.

Kokomo has taken kindly to the use of electric heating and cooking appliances, and there is hardly a consumer of electricity who has not some kind of electrical convenience of this kind. Five families in the little city have all-electric kitchens, doing all their cooking by electrical energy at 5 cents per kw-hour, which is the special rate granted for this service when measured through an independent meter. Those families who use electricity for cooking express themselves as thoroughly delighted with its convenience and cheapness, although the electric company has learned that at the rate granted for this kind of service electric kitchens are not altogether good business from the central-station standpoint. The number of burn-outs of heating elements, which are all brought back upon the electric company for repair or renewal, has been a source of annoyance, so that the heating and cooking utensil business has not been pushed in Kokomo nearly as much as the general acceptance of the devices would warrant.

None of the five kitchens arranged for electric cooking has any alternative means of heat, and complete dependence is placed on the electric outfit. A typical Kokomo electric kitchen is that of Mrs. Herbert Murden, shown in the accompanying photograph, and which comprises:

| | | | |
|---|---|---|---|
| Large frying pan | 1400 watts | Broiler | 1100 watts |
| Small frying pan | 550 watts | Percolator | 900 watt |
| Hot plate | 900 watts | Cereal cooker | 900 watts |
| Chafing dish | 650 watts | Oven | 1650 watts |
| Tea-kettle | 800 watts | | |

The consumption of this particular electric kitchen ranges from 100 kw-hours to 150 kw-hours per month, food being prepared for two persons. In other instances where there are as many as five in the family, the monthly bill does not exceed $4 to $6. The minimum monthly charge for the separate meter which is installed on each electric kitchen is, as in the case of any other service meters, $1. Precautions are taken that good current-carrying capacity is provided each kitchen, and special transformers are usually installed very close by to insure an ample supply of energy without affecting the voltage at the lamps of other residences.

The company supplies 207 series street-arc lamps in Kokomo, for which it receives $60 per lamp a year. On the principal business streets special incandescent arches have been installed for several years. The cost of lighting and maintaining these is collected from those merchants having stores nearby who are willing to help defray the expense. Each of the seven arches with its 50 8-cp carbon lamps costs $15 a month to light. Each merchant who contributes to the lighting fund pays from $0.50 to $2 a month. Plans are now on foot to replace this obsolete arc form of lighting with multiple tungstens on concrete pillars. A sample of this curb lighting, installed in advance by a progressive merchant, is shown in Fig. 6. Four posts, each carrying three 100-watt tungstens, will be erected in each block at the expense of adjacent owners and will be paid for out of the city lighting fund.

As before noted, energy from the Kokomo generating station is employed to light and to supply energy for motors for Greentown, Swayzee and Converse, which are adjoining villages of 1500, 1500 and 2000 population, respectively. The retailing of electric service in the first two named is handled by the traction company itself, while the business at Converse is controlled by a company which purchases its supply at the local switchboard. After meeting the transmission, distribution and metering charges, this energy is sold to customers

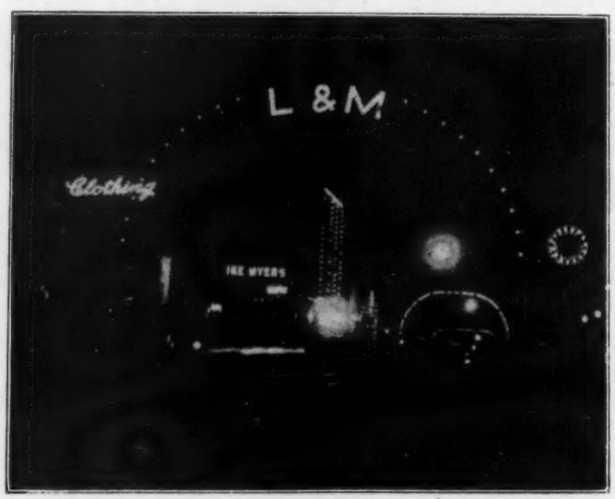


Fig. 5—Decorative Arches and Special Lighting, Kokomo.

at the rate of 10 cents per kw-hour. The Converse load is well-proportioned, carrying a number of motors during the daytime and some all-night street lighting.

In Kokomo and vicinity at least 100 distinct industries are supplied with electrical energy for their motors, aggregating about 1400 hp in connected load. Much of this aggregate rating

Fig. 6—Special Tungsten Pillar Lighting Main St., Kokomo.

represents steam power that has been supplanted by the presistent power-business promotion of the company's solicitors.

Perhaps the largest single installation using energy from the Kokomo system is a stone quarry near town, from which approximately 10,000 cu. yd. of road ballast is taken per month. Over 300 hp in 220-volt, two-phase motors are in use for drill-

Fig. 7—Electrically Operated Drill, Shovel and Crusher in Stone Quarry.

ing, shoveling and crushing the rock. A 10-hp motor connected by portable cables drives the drill used in loosening the rock. The 40-ton shovel employed for loading the broken talus into the cars is equipped with a 60-hp hoist motor, a 30-hp thrust motor and a 30-hp motor for operating the shovel swing motion. For the hoisting and crushing operations 150 hp in

Fig. 8—Motor-Driven Drill and Shovel in Quarry.

squirrel-cage motors is employed in the crusher house. A 30-hp motor driving a centrifugal pump is also installed to free the quarry of the water which constantly drains into the pit. The energy consumption for producing a cubic yard of crushed stone is about 1½ kw-hours. For hauling the crushed rock away from the quarry a 240-hp locomotive capable of handling six loaded cars is used.

An accompanying illustration shows how a motor was installed to replace a steam engine in a paper mill. In general, drives of this kind are a class of business difficult to get, as steam is used for cooking the pulp, thus making the operation

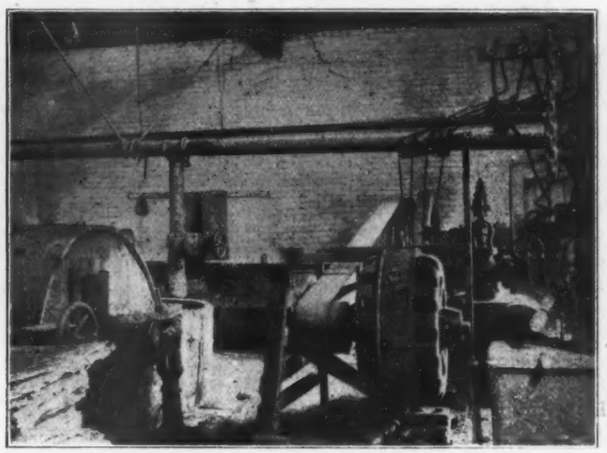

Fig. 9—75-HP. Motor Belted to Engine Flywheel, Driving Pulp Beaters in Paper Mill.

of an engine very economical. In the instance shown, the motor is belted onto the engine shaft, from which the connecting rod has been disconnected. Before the motor was installed the mill owner held out against the use of central-station energy, as the dismantling of his engine, he said, would make it impossible to utilize the refuse which collects and which is from time to time burned as fuel. As the motor is now installed, belted to the shaft wheel, the engine piston rod can be put in place when necessary and the mill operated by steam power until the refuse is consumed. The installation shown comprises a 75-hp, 220-volt, two-phase motor driving three 600-lb. pulp beaters. This load continues for 24 hours daily throughout the year during the operation of the plant. About 30,000 kw-hours per month is consumed by this installation, including the lighting of the plant.

Another paper mill in this district, which employs 200 hp in engines to operate its beaters and paper machines, utilizing the exhaust steam for cooking the paper, has recently added 100 hp

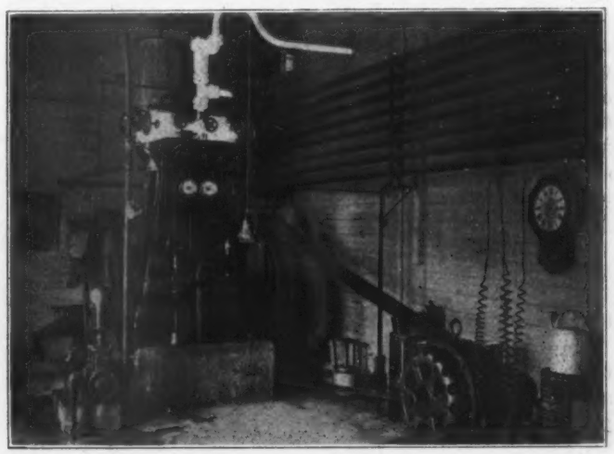

Fig. 10—Motor-Driven Ammonia Compressor in Refrigerating Plant.

in motors to this equipment, and also employs electrically driven pumps, paper cutters, gluing machines, machine tools, etc.

In the local steel and wire mill 200 hp out of the 5000 hp required at this plant is already being supplied by motors, and the electrical generating equipment commonly operated during

the daytime has been shut down and its place taken by central-station supply.

A local brass works has 100 hp in motors installed; a drill-bit factory takes 85 hp; two of the three local automobile factories employ electric drive, and other large customers of the traction company are a spark-coil factory, two machine shops, three glass factories, flour mills, grain elevators, a planing mill, a knitting works, lumber yards, etc. Curiously enough, too, the traction company supplies energy for operating a 5-hp pumping motor for the water tank of its steam-railroad competitor, the "Clover Leaf," along the line of its transmission.

During the past year the new-business department of the electric company has devoted its soliciting efforts to the development of the motor field, extending its lines to connect with this class of larger business. Feeling its position now secure in this direction, the company has turned its attention toward the enlargement of residence and other small business on its already existing lines. As the result of this change in policy, the future business of the company will be carried on at even a greater apparent profit than when heavy investments were required in distribution line extensions.

The officers of the Kokomo, Marion & Western Traction Company are: President, Mr. G. J. Marott; vice-president, Mr. L. J. Kirkpatrick, and secretary-treasurer and general manager, Mr. T. C. McReynolds. Mr. P. H. Palmer is assistant general manager and superintendent of the lighting department, and Mr. O. M. Booker is solicitor, lately having taken the position previously filled by Mr. C. E. Layton. Mr. C. C. Trees is auditor and Mr. Matzoff is superintendent of transportation.

## AMERICAN SWITCHBOARD PRACTICE—I.

### Influence of Distant-Control Switchgear on Alternating Current Station Design.

By Stephen Q. Hayes.

THE influence of distant-control switchgear on station design is becoming a more and more important factor as the size and voltage of generating, transforming and distributing stations increase. For this reason a short investigation of some of the more important features of modern switchgear with their direct and indirect influence on station design may be of interest and value.

In the early stations of small size and low voltage the switchgear usually comprised a few knife switches, fuses, indicating devices and lamps mounted in a more or less haphazard manner on the walls of the station and practically no space whatever was taken up by this switching apparatus. The next step in advance was to assemble the apparatus on a switchboard and to locate this switchboard near the station wall or in any place not otherwise occupied by engines, generators and similar machinery. The switchboard, as a rule, was the last thing to be located and was looked upon as about the least important part of the equipment. With the further increase in the output and voltage of the circuits to be controlled, it was found generally advisable and often essential to take more space for the switching appliances than could be arranged for on a panel switchboard and distant-control switchgear was the natural result.

It has become the usual practice in alternating-current installations of 2200 volts and above, having ratings of more than 2500 kva, seriously to consider using distant-control switchgear and as the size and voltage increase the practice becomes more nearly universal. In certain cases even of smaller ratings or lower voltage, distant control is adopted. For moderate-sized stations hand operation is used for the switchgear, but some auxiliary source of power is employed in practically all alternating-current stations of 10,000 kva or more, and frequently in smaller ones. Such auxiliary control is found advisable owing to the amount of power to be handled, the physical exertion required to manipulate large apparatus, the number of circuits to be controlled, the high voltage used, the advisability of concentrating the control of widely scattered devices or for other similar reasons.

It is self-evident that all of this distant-control apparatus must be located somewhere, and it is the idea of the writer to suggest by examples the proper location for such apparatus in the station. To secure the best results careful consideration must be given to the question when the station is being designed, or otherwise great difficulty is apt to be experienced in securing satisfactory results. This question of switchgear may be considered under three heads: (1) Switchboards comprising the panels, pedestals, desks and posts containing the instruments and control devices. (2) Apparatus consisting of switches, circuit-breakers, rheostats and similar devices. (3) Layouts including the arrangement of the structures for the breakers and busbars as well as the relative location of generators, transformers, feeders and their switching equipment. This article deals almost exclusively with the station layout, as it is considered impracticable to attempt to cover the switchboards themselves and the apparatus in a short article, although a few words regarding them may be advisable.

The panel type of switchboard is normally used where the number of circuits is comparatively small or where the number of instruments desired for each circuit is so large that the space needed for the meters practically necessitates this type of construction. Pedestals and instrument posts are frequently used for generator circuits where self-contained units are wanted and with this construction it is customary to control the feeders from a panel board. Where concentration of the control equipment is essential the benchboard or desk is usually the most convenient type of switchboard to use.

Concentration of control necessitates arranging all of the switchgear for distant operation either manually or by some auxiliary source of power, and this has resulted in the development of electrically actuated devices for carrying out all of the operations necessary for the control of a power plant. The exciter main switches and generator field switches are sometimes provided with operating solenoids, while the rheostats have solenoids or motors to drive them. Similar devices can be furnished for governor speed control and occasionally for valve control, allowing a machine to be started, brought up to speed and voltage and connected to the circuit by the operator manipulating a few control devices located on the switchboard.

The satisfactory operation of the station hinges principally on the switching appliances supplied for the control of the main circuits, and while various types have been designed from time to time, oil switches and circuit-breakers have practically superseded all other types for handling alternating-current circuits of large output and high voltage. An oil switch or circuit-breaker consists essentially of a device for opening a circuit under oil in a more or less restricted space and it has been found that when circuits of large current capacity are opened in this manner under conditions of overload or short-circuit explosions sometimes occur that blow oil out of the breaker and occasionally rupture the tanks. For this reason it is customary to locate oil circuit-breakers carrying heavy currents in masonry compartments and usually so to design the breakers that each pole is in a separate compartment. The busbars and connections are also placed in masonry compartments so designed that leads of opposite polarity are separated by walls, shelves or septums in such a manner that if trouble occurs in one compartment it will not be communicated to the adjacent ones, and the proper design of such compartments is of great importance.

This article deals particularly with the general arrangement and relative location of the breakers, busbars and similar devices and the effects of their location on the broad problem of station design. In an article of this kind it is, of course, impossible to show all of the various station designs of different companies for different voltages, so a few representative plants have been selected principally to show the influence of switchgear on station designs intended for various voltages.

It will be noted that the various installations illustrated in this article are provided with top-connected, solenoid-operated, oil circuit-breakers, but bottom-connected, motor-operated breakers can also be used. Most of the features of station de-

sign, as illustrated and described, although taken from the design of one company, would apply almost as well to the installations furnished by other manufacturers, although the type of switchgear employed has a great deal to do with the best relative location of the circuit-breakers, busbars and similar appliances.

For the purpose of this article alternating-current stations may be considered as divided into the following classes: Converting stations, generating stations and transforming stations. This classification is, of course, more or less arbitrary and the same plant frequently would come under two or more of these headings, so a few words of explanation may not be amiss as to why this classification has been adopted.

In converting stations, whether provided with rotary-converters or motor-generator sets, there are no prime movers to be considered and the apparatus can usually be located to better advantage and can be arranged in such a manner as to simplify the switching equipment and to make the wiring as short and direct as possible.

In generating stations provision has to be made for the generators with their prime movers and auxiliaries as well as for the switching equipment, which may or may not occupy a comparatively large amount of space. These stations, as considered in this article, are stations where practically all of the energy is sent out at the generator voltage, no provision being made for step-up transformers. These stations, as a rule, are limited to a voltage of approximately 13,200 volts and are ordinarily used for railway service, or central-station service in large cities where underground distribution is required.

Transforming stations as considered in this article comprise either generating stations or receiving stations where the bulk of the energy passes through either step-up or step-down transformers, and where the switchgear is consequently grouped in connection with these transformers in order to secure the most satisfactory results.

### CONVERTING STATIONS.

When converting stations provided with rotary-converters or motor-generators do not contain any prime movers they present many opportunities for skilfully designing the plant in such a manner as to secure the simplest arrangement of building and the best location for the switching equipment is frequently the governing feature in the design. The proper grouping of the apparatus in a rotary-converter station depends, of course, on the voltage of the alternating-current circuit, size of rotaries,

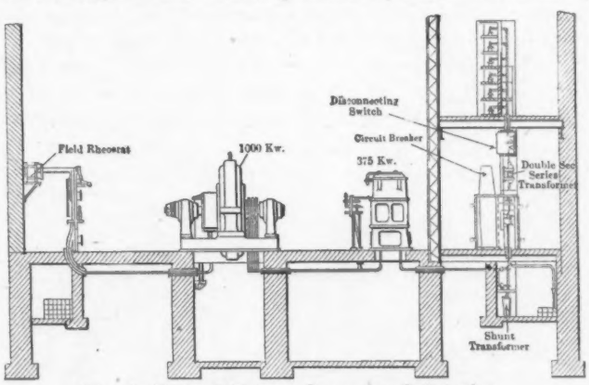


Fig. 1—Typical Rotary Converter Substation.

type of transformers and similar features, and the building varies accordingly, provided the shape and size of the available lot is such as not to hamper the design of the station.

It is, of course, impossible to illustrate and describe the many different combinations of transformers, rotaries, etc., installed by various manufacturers in different plants, so what is practically the standard design of one company for large rotaries fed from underground circuits is used to illustrate some of the features in the design of the station that depends on the switching equipment.

Fig. 1 shows a sectional view of a rotary-converter substation containing 1000-kw, six-phase rotaries with air-blast transformers fed from 13,200-volt underground circuits. As may be noted, the incoming leads from the cable duct pass through an oil breaker and disconnecting switches to the busbars that are located on a gallery, and provision is made for an additional set of busbars and additional set of disconnecting switches to be installed at a later date so that any breaker may be connected to either of the two sets of buses.

The circuit from these busbars passes back through other disconnecting switches and breakers to the high-tension terminals located at the bottom of the air-blast transformers. The low-tension leads from the transformers go to a starting panel provided with double-throw disconnecting switches that permit one-third and two-thirds of a normal voltage to be impressed on the rotary for the purpose of starting. The rotaries are provided with a series field circuit on the negative side, and the negative and equalizer switches are placed on a pedestal at the machine, and the negative and equalizer buses run on a bracket in the basement. The positive leads run to the panel board near the left-hand wall and the positive bus is located on the back of this board. The railway feeders are run out through underground ducts and the entire wiring of this station is very straight away from the high-tension incoming lines to the low-tension outgoing feeders. All of the high-tension circuits are provided with electrically operated breakers controlled from the main switchboards. As may be noted, the entire design of this station hinges on the proper arrangement of the switching equipment.

A similar arrangement of stations can frequently be utilized to advantage where motor-generators are used instead of rotaries and the circuit-breakers for the motors can frequently be arranged along one side of the building. The corresponding switching equipment for the generators can be placed on the other side of the building and all of the apparatus controlled from a single point. With such an arrangement the wiring is kept very straight and simple and the space is utilized to the best advantage.

### GENERATING STATIONS.

Generating stations from the viewpoint of their switching equipments may be considered of two types, one distributing at the generator voltage, and the other stepping up the voltage by means of transformers before feeding out to the line. The former type is the one covered in this section of the article, while the latter type, in this paper, is spoken of as a transforming station because it is customary to devote a certain portion of the building or a separate building to the transformers and switchgear. Many stations, of course, feed out both at the generator voltage as well as at a higher one.

The end of the building is a favorite location for the switchgear when the number of circuits is such that this location provides sufficient space for the breakers and the busbars, making due allowance for probable future additions. With this arrangement it is customary to provide a number of galleries for the switching equipment, and the switchboard, whether in the form of panels, pedestals or control desks, is usually placed on one of the upper galleries so that the station attendant can readily watch the operation of the machines which he is controlling.

Fig. 2 shows a sectional view taken through the switching galleries located at one end of a comparatively old plant which contains a large number of 6600-volt generators and feeders. The generators are controlled from pedestals and instrument posts, while the feeders are controlled from a panel board, all of this switchboard being located on the top gallery. The operator standing at the control pedestals faces the generator room and by looking down can watch the machines he is controlling or by looking up can see the instruments that indicate the current, voltage, output, power-factor, etc., of the various machines. In this plant the generator leads are carried up the pilasters that support the front of the gallery and pass through breakers on the top gallery to the generator bus, returning through selector breakers to either of the two sets of busbars that are located on the upper mezzanine gallery. These main busbars in turn connect to the feeder selector breakers on the lower mezzanine and thence through the main feeder breakers

on the engine-room floor. The position of the series and the shunt transformers, disconnecting switches, barriers, etc., are clearly shown. The exciter and the auxiliary control board was placed on the engine-room floor, while the electrically operated field rheostat face plates for the generators, with their resistances, are placed on the lower mezzanine gallery.

In this particular plant each generator and each feeder are provided with one main and two selector breakers, so that there were always two breakers in series between any generator or feeder and the busbars. This provision was made to guard against the possible failure of an oil circuit-breaker, but it has been found that such dependence can be placed on the modern oil circuit-breaker that it is now seldom considered necessary to use two breakers in series.

Where the end of the building does not provide sufficient space, the switching equipment is frequently located along one of the side walls, usually the side remote from the boiler-room in a steam station or the penstocks in an hydraulic station. The switching equipment when arranged in one or more galleries along the side of the building can easily be extended as the

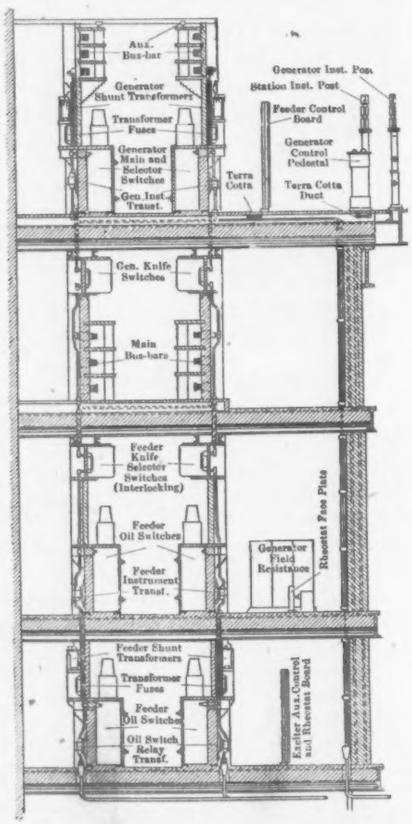


Fig. 2—Generating Station, Switching Galleries at End.

space available for the switchgear increases proportionately with the space available for the generating equipment if the building is lengthened. With this arrangement it is usually customary to locate the generator breakers directly opposite the individual machines and to run the busbars the length of the station. In this manner the length of the generator leads will be reduced to a minimum and it is sometimes possible to use bare conductors for these leads. The switchboard itself, if electrical operation is provided, may be located either on one of the side galleries or at the end of the building in such a position that the switchboard attendant can readily watch the operation of the machines which he is controlling.

Fig. 3 shows a section taken through the switching galleries of a plant where the circuit-breakers, busbars, etc., are located on galleries along one side of the building. This station contains at present two 7500-kva, 25-cycle, 6600-volt, three-phase turbo-generators; three 10,000-kva turbo-generators, with provision for five additional turbo-generators, which will probably be of 10,000 kva rating. These machines, while now connected for 6600 volts, will later be reconnected for 11,000 volts, and all of the circuit-breakers, busbars, disconnecting switches, etc., in this plant have been designed with this end in view. As shown in the right-hand portion of the engraving the generator circuit-breakers are located on the top gallery and leads are

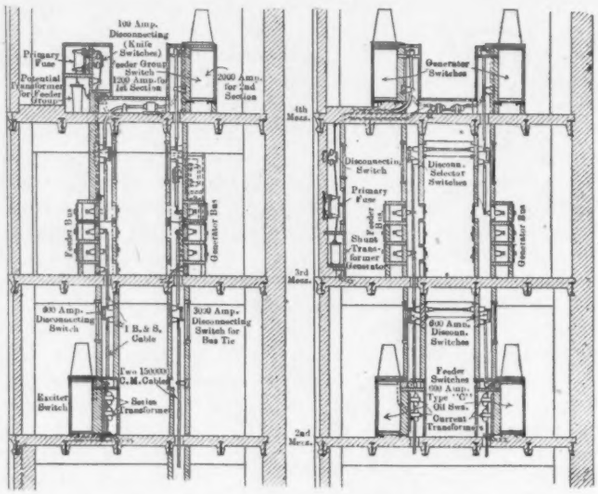


Fig. 3—Generating Station, Switching Galleries at Side.

brought in suitable ducts to this point. The series transformers for the generator circuit are located under a false floor and the leads after passing through these transformers go into the oil circuit-breakers, then drop down through the floor to disconnecting switches and to the busbars. In addition to the generator breaker on the top gallery, group breakers are also installed, while on the lower gallery are located the feeder breakers and bus tie breakers.

The location of the disconnecting switches, series and shunt transformers, busbars and connections is clearly shown, and it may be noted that in front of the disconnecting switches have been placed doors with clear wire-glass panes so that the position of the disconnecting switches may be readily seen without opening the doors. The busbars are located in masonry compartments completely enclosed, but doors are provided opposite each terminal in order to facilitate inspection.

In this installation the generators are controlled from a desk placed on the upper gallery at what will be the center of the complete station, and the desk is so arranged that the station

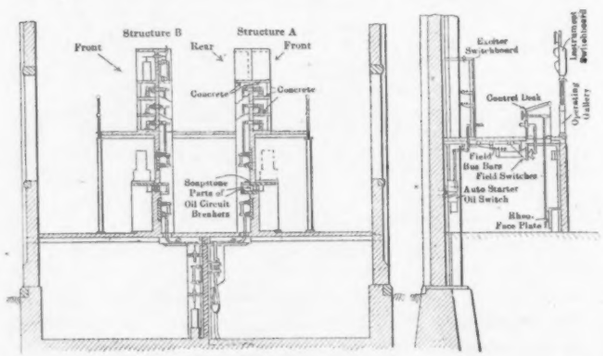


Fig. 4—Generating Station with Separate Switch House.

attendant will face the generator-room and can watch the machines he is controlling, as it is possible to see over the top of the desk and underneath the frame which contains the generator instruments. The feeder circuits in this station are controlled from a panel board arranged to form an arc of a circle, which board is at the back of the station operator when he is standing at the control desk. This arrangement of generator

control desks and feeder panel boards is very compact indeed.

As an example of an independent switch house, Fig. 4 shows a section through the switching galleries of a plant which controls a number of 13,200-volt generators and feeders. Both the generators and the feeders are controlled from a desk in the generator station, which desk is located on a platform so that the operator can readily observe the machines he is controlling. In this station the field rheostat and field switches are hand operated. The leads from the generators are brought in three-conductor cables to the basement of the switching house, and after leaving the cable bells the single-conductor leads pass through series transformers to either or both of two oil circuit-breakers and thence to the main busbars. The feeder circuits are in a similar manner connected to these two sets of busbars through two circuit-breakers.

In this installation the disconnecting switches that isolate the oil circuit-breakers are placed directly in the back of the circuit-breaker structure, so that there is practically no likelihood of trouble arising from one station attendant closing the disconnecting switches while a second attendant is working on the breaker. The arrangement of the circuit-breaker, disconnecting switches, series and shunt transformers, busbars and barriers is clearly shown. As may be noted in Figs. 2, 3 and 4 the type of circuit-breaker used in these installations can be readily connected to busbars either above the breaker or below the breaker, and all of the circuit-breaker leads can run up or all down or some each way.

## THE COST OF ELECTRICITY.

BY W. D. MARKS.

IN the *Electrical World* for Sept. 2, 1909, the writer discussed the price of electricity, using for that purpose the reports of some 17 Massachusetts companies to the Board of Gas and Electric Light Commissioners of that state. This discussion then deferred the consideration of the cost of electricity and, as will be the case also in this article on costs, confined its considerations entirely to financial methods and data, omitting any reference to the physical methods of producing electricity, or of distributing it, as of minor commercial importance compared with the financial laws and methods developed. In fact, the expansion and prosperity of a commercial electrical enterprise depend far more on the grasp and ability of its management than on the perfection and economy of its machinery.

The points developed in the article of Sept. 2, 1909, were as follows: "If increased sales (of electricity) at a lower profit per unit result from lowered prices, this increased sale also reduces the investment or capital per unit sold and so the same or greater profits or dividends may result from lowered prices, if the plant does not have to be appreciably enlarged for the greater sales."

Going to bedrock for the foundations of a severely practical investigation the various details of 17 companies in practical operation in Massachusetts were analyzed and the hitherto hidden empirical law of demand for electricity was brought to light. It is $s = (640 \div p) - 45$; in which $s =$ the sales per capita in kw-hours, and $p =$ the average price per kw-hour in cents.

In Fig. 1 this law is graphically laid down and compared with the actual practical results in 15 Massachusetts cities ranging from 132,000 to 33,000 population. For all practical purposes this law's verification appears complete within a range of from 4 cents to 10 cents average prices per kw-hour for electricity, now received by prosperous companies paying generous dividends. The response of the public, in increased consumption, to lowered prices is sure and regular.

Only one of these companies has water-power for a portion of its load. The rest are practically (save in population) identical as to cost of fuel, labor and construction and situated in cities of like climates and equal wealth per capita and use steam power only.

Further in the article mentioned reference was made to the average cost of a municipal electric light station and distribution system per kilowatt of station capacity and also to the wide differences in the capitalization and assets per kw-hour sold, ranging from 9.25 cents to 53.5 cents, depending on the annual hours of use of the full capacity of the station, the annual hours also ranging from 4000 hours to 700 hours per year.

With this much of recapitulation of matters already covered, required for a full comprehension of further investigations, the discussion of the cost, and consequently the price of electricity as obtained from profitably operating electric stations, can be taken up on the same severely practical basis of actual operating results.

### PER CENT PROFITS ACTUALLY REALIZED.

Absolutely practical derivation from many instances is the condition of value in such an investigation as this, and actual results attained are the only facts upon which the reasoning must rest.

The writer has no impartial inventories of the 15 electric plants used for the purpose, but in their reports to the Massachusetts Gas and Electric Light Commission finds the tax valuations of 12 of them. The tax value of a plant may be less than its real value, since tax assessors generally seem to assess the values of properties at a certain percentage of their known cost or of their present value. The available tax values may be considered in the absence of other data as the lowest appraisements possible to be mutually agreed upon by the tax assessors and the company's officials. Depreciation of plant will surely be included by the company and the assessors must permit the cash and stock of materials used in operation to be omitted from the tax returns.

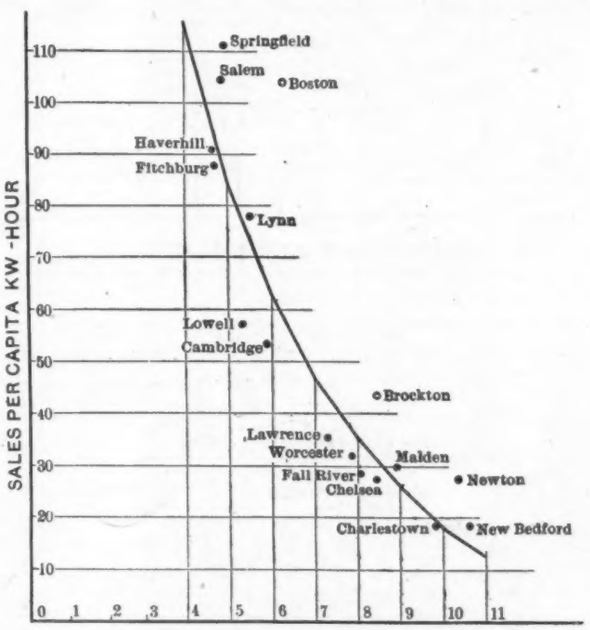


Fig. 1—Curves Showing Sales of Electricity per Capita.

These considerations operate to produce an apparently smaller investment per kw-hour sold, but as these plants are taxed under the same state law, the result is only to produce a proportionate reduction of apparent value, leaving the figures valuable for comparisons with each other.

In the case of each of these 12 companies the cost of a kw-hour is obtained by dividing the total operating expenses by the total number of kw-hours sold. Depreciation for the current year is temporarily omitted from expenses for a reason to be hereafter explained. The tax investment per kw-hour is obtained by dividing each company's tax valuation by the total sales in kw-hours. The data for the subjoined tabulated

results are taken from the Massachusetts Gas and Electric Light Commission report to June 30, 1908.

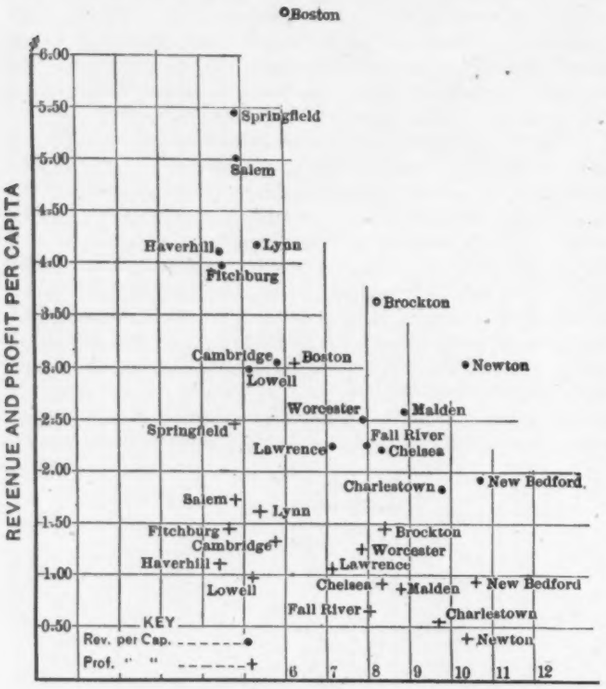


Fig. 2—Curve Showing Revenue and Profit per Capita.

FIRST GROUP OF 1908.

| Cities | Cents per kw-hour | | |
|---|---|---|---|
| | Average Price | Cost | Tax Investment |
| Springfield | 4.86 | 2.64 | 15.3 |
| Salem | 4.80 | 3.13 | 10.8 |
| Haverhill | 4.31 | 3.21 | 11.9 |
| Fitchburg | 4.57 | 2.99 | 13.4 |
| Lynn | 5.41 | 3.27 | 8.5 |
| Lowell | 5.19 | 3.50 | 19.3 |
| Cambridge | 5.79 | 3.24 | 20.2 |
| Averages | 5.02 | 3.14 | 14.2 |

Profit per kw-hour ..... =1.88 or 13.2 per cent on 14.2 cents

SECOND GROUP OF 1908.

| Cities | Cents per kw-hour | | |
|---|---|---|---|
| | Average Price | Cost | Tax Investment |
| Lawrence | 7.16 | 4.06 | 18.9 |
| Worcester | 7.86 | 4.03 | 28.6 |
| Newton | 10.40 | 9.33 | 14.4 |
| Malden | 8.89 | 6.05 | 22.0 |
| Fall River | 8.00 | 5.70 | 26.9 |
| Averages | 8.46 | 5.83 | 22.2 |

Profit per kw-hour ..... =2.63 or 11.9 per cent on 22.2 cents

As a practical fact it may be observed from the above tabulation that the lower price (5.02 cents) produces an average profit of 13.2 per cent, as against a lower profit of 11.9 per cent for the price of 8.46 cents per kw-hour on the basis of the tax valuation of the investments in these companies.

With the exception of Springfield, favored by water-power, it would be impossible to find a group of 12 companies operating under more nearly the same conditions save as to population.

It is, therefore, safe to infer that an average reduction of 3.44 cents in the price by the first group has not reduced the percentage of profit on the investments made by this group's companies. On the contrary, the profit is increased 1.3 per cent by the lowering of prices, and the sales per capita computed by the law of demand above stated would increase from about 30.6 kw-hours per capita annually to 82.5, an increase of nearly threefold in sales.

From the point of view of citizens desiring to increase the manufacturers and consequently the commercial prosperity of their cities, rationally regulated low prices for electricity for long-hours use are a boon whose value cannot be overestimated. Another point of view of the reduction of the operating cost of producing electricity by reason of the increased sales per capita is illustrated in Fig. 3. Depreciation for the current year, as before, is also temporarily omitted in this diagram. The broken-line average cost curve laid down by a similar method to the price curve appears to have the same rude approximation to hyperbolic law and to be a function of the sales per capita. The fact may be observed that the price and the cost of supplying electricity move down together as the sales per capita increase and that there always is an average profit shown on each kw-hour sold, which varies very little while going from 10 cents to 4 cents average price per kw-hour sold.

### DEPRECIATION.

Each year, in order to compute the total cost per kw-hour sold of electricity, it is necessary to include the depreciation per kw-hour; and yet the depreciation cannot be considered as proportional to kw-hour sales. It is customary in many electric works to allow a certain average percentage of the value of the works, fixed plant or as above figured of its taxable value. This percentage is a much disputed quantity, but in fairly equipped works it is hardly ever claimed to be less than 3 per cent or over 7 per cent. In fact, any percentage is a guess, and a careful inventory and appraisement furnishes the only means of fixing depreciation accurately. In this appraisement care must be taken to discriminate between physical decay, obsolescence and inadequacy of plant. The current repairs are usually charged to operating expenses as they occur, and physical decay becomes less in proportion to the thoroughness of repairs.

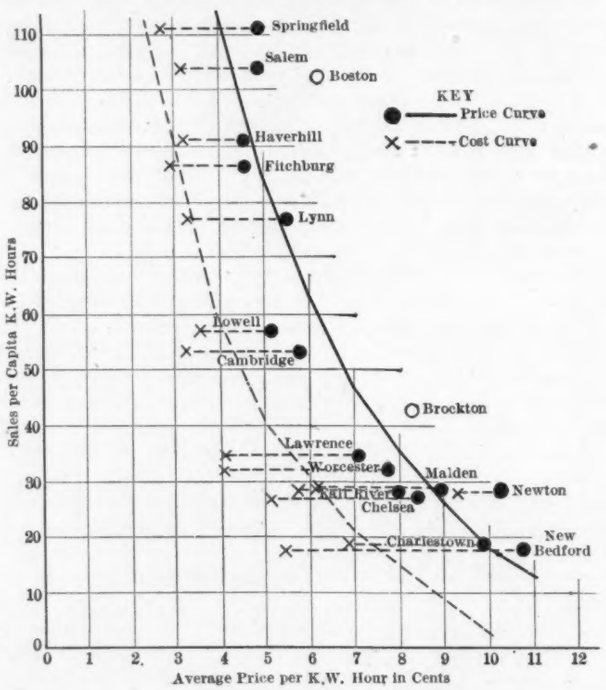


Fig. 3—Curve Showing Sales per Capita, KW-Hours.

In the 12 Massachusetts companies cited the depreciation is not charged to operating expenses, but is charged directly to profit and loss, if at all, and credited to various accounts. If one assumes the extremely liberal average of 7 per cent de-

preciation, the first group of seven low-priced companies earning 13.2 per cent is able to divide 6.2 per cent of the tax value and to put aside a 7 per cent reserve depreciation fund; and the second group of five higher-priced companies earning 11.9 per cent is able only to divide 4.9 per cent and put aside 7 per cent.

### GENERAL CONSIDERATIONS.

For the first group the following obtains:

| | | |
|---|---|---|
| Price | | 5.02c per kw-hour |
| Operating expense | 3.14c | " " |
| Depreciation | 0.99c | 4.13c " " |
| Net earning | | 0.89c " " |

For the second group the following obtains:

| | | |
|---|---|---|
| Price | | 8.46c per kw-hour |
| Operating expense | 5.83c | " " |
| Depreciation | 1.55c | 7.48c " " |
| Net earning | | 0.98c " " |

The second group shows the larger profit per kw-hour, but it gives a smaller per cent profit on the investment made.

The explanation of this stubborn series of facts appears to be the following: With a rational method of lowering prices the response of the public to it is a sure increase of sales per capita according to the law of demand exhibited above. (See article, Sept. 2, 1909). The increased sale of energy results in a decreased operating cost per kw-hour sold and also usually results in a decreased investment per kw-hour sold. The decreased investment per kw-hour results in a decreased depreciation per kw-hour sold, since depreciation depends principally upon time and the cost of the investment.

For these reasons the per cent of profit on the investment required appears rather to be increased than decreased by a rational lowering of average prices down to a limit of 4 cents per kw-hour, beyond which point practical data are not obtainable from Massachusetts electric light companies (see Fig. 3).

Since fuel, the largest factor increasing with the load, will rarely exceed 25 per cent of the operating expenses, its increased cost with the kw-hours sold is over-compensated by the other decreases in operating expenses, in depreciation and in investment, per kw-hour, thus producing the lessened cost per kw-hour and the increased per cent of profit on investment computed in groups 1 and 2 and graphically shown in Fig. 3 from actually realized results.

It should be noted, too, that the physical differences in the character and economy of the operative machinery of the various stations do not appear to have appreciably affected their results in sales.

With this elucidation of the general principles governing the supply and sale of electricity based as yet entirely on average prices, the method of attaining the low rates found so profitable, both by the public and the public-service electric companies, can be considered.

### METHOD OF COMPUTING PRICES TO CONSUMERS.

There is but one right method of computing judicially fair prices to consumers, and there are innumerable wrong methods. Superficial theories and incorrect reasoning and data appear to be common alike to the managers and to the consumers of electric light companies. In some instances local causes and obscure influences will greatly vary the results attained by companies and must be eliminated.

In the article of Sept. 2, 1909, the general principles forming the basis of a proper sliding scale have been stated and a crude computation of a table used profitably in 1890 in the Philadelphia Edison Company given merely as an illustration of the method. The later 1909 results of a nameless electric light company in a city of 132,000 population will, therefore, be used in the formation of a series of sliding scales, based on a more careful examination and separation of the quantities to be segregated under two heads. (1) The capacity of the public service demanded by a patron. (2) The quantity in kw-hours of the commodity electricity actually consumed by a patron.

The first head covers the amount of wages and hire of the station machinery and staff of employees required by a consumer for his possible use. The second head covers the exact cost of the kw-hours supplied to each consumer. The first usually covers the fixed expenses due to the capacity (regardless of the commodity sales), such as the fixed annual expenses for office and general management, together with the profit on, and the depreciation of, the capacity demanded by a patron. The second is the cost of supplying a measured quantity of electricity to a patron.

The data required for the practical construction of the various sliding scales of rates to patrons in such a manner that each shall pay an even profit to this company for services rendered are as follows:

The total income for the year 1909 was:

| | | | |
|---|---|---|---|
| Public street arc lamps | | $77,002.00 | |
| Public street incandescent lamps | $3,361.50 | | |
| Comm. arc lamps, contract | 14,796.89 | | |
| Comm. arc and incand. lamps, meter | 198,197.18 | $216,625.57 | |
| Electric motors | | 53,915.96 | $347,543.53 |
| Total operating expenses | | $171,549.78 | |
| Average 5 years' depreciation | | 79,441.67 | 250,991.45 |
| Net annual earnings | | | $96,552.08 |
| Dividends paid 10 per cent $800,000. Capital stock | | | 80,000.00 |
| Undivided surplus | | | $16,552.08 |
| Sales, 4,879,973 kw-hours @ 7.12 cents | | | $347,543.53 |
| Cost, 4,879,973 " @ 5.14 " | | | 250,991.45 |

The capacity of the connected load appears to be about:

| | | | |
|---|---|---|---|
| Public street arc lamps | 330 kw or | 4.27 per cent | |
| Commercial lighting | 5,922 " " | 76.73 " " | |
| Electric motors | 1,469 " " | 19.00 " " | |
| Total | 7,721 kw or | 100.00 per cent | |
| Annual hours use per kw connected load | 632.04 | | |
| Daily " " (307 work days in the year) | 2.06 | | |
| Total assets reported 1909 (checked by tax) | | | $1,472,523.06 |
| Assets per kw of connected load | | | 190.7166 |
| Net annual profit 6.53 per cent, $1,472,523.06 | | | 96,552.08 |

If the assets are divided in proportion to the capacity of the connected load served the following obtains:

| | |
|---|---|
| Public street arc lamps | $62,936.48 |
| Commercial lighting | $1,129,423.71 |
| Electric motors | 280,163.00 |
| Total | $1,472,523.19 |
| Variation in decimals | 0.13 |

Since there are 845 public street arc lamps of the 4-amp (390 watts) type served through underground conduits, and also no segregation of assets or appraisement of plant, one is obliged to reject $62,936.48 as too small and substitute an estimate covering the cost beyond doubt of 845 lamps and appurtenances, 375-kw (500-hp) engine, boiler and appurtenances, real estate shared, 242 miles copper No. 6 and 100 miles of duct, making a total of $290,000, or about $343 investment per lamp.

With the use of underground service, $190.72 per kilowatt capacity of connected load as a practical result does not appear to the writer to be an excessive investment, and it will, therefore, be used as an approximate and fair basis in the sliding scales for computing 5 per cent profit and 7 per cent depreciation on commercial lighting and electric motor circuits as being without doubt liberal treatment of the electric company.

### STREET LIGHTING COST.

The contracts for the public street arc lamps are usually made

yearly on the basis of a regular 10.8 hours of lighting each night for 365 nights, and will be more conveniently dealt with before the discussion of the sliding scales is taken up.

| | |
|---|---|
| Cost of energy 1,301,000 kw-hours @ 2 cents | $26,022.00 |
| Fixed expenses 330 kw @ 9.58 | 3,161.40 |
| Depreciation $290,000 @ 7 per cent | 20,300.00 |
| Total operating cost 845 lamps | $49,483.40 |
| Profit $290,000 @ 5 per cent | 14,500.00 |
| Price 845 lamps @ $75.72 | $63,983.40 |

Dismissing this special street-lighting service requiring so small a per cent of the capacity of an electric light station, the consideration of the data required for fixing the cost and price of kw-hours consumed by patrons not bound to regular hours' use, but charged for from the records of an electric meter may be resumed.

### COST AND PRICES OF METERED ELECTRICITY.

The present used system of metering electricity to consumers in kw-hours is exceedingly unsatisfactory, since each successive kw-hour supplied to a consumer costs less than its predecessor owing to the presence of an annual service charge due mostly to the impossibility of cheaply storing one day's supply. For instance, in the present case of two hours' average daily use of 7721 kw connected load the highest demand upon 4960 kw of installed generating machinery has proved to be 3000 kw. If, however, electricity sufficient for 24 hours could be stored, the station could be operated 24 hours with one-half of one-sixth of 7721 kw or 1287 kw capacity and the annual service charge for idle investment almost ignored.

### OPERATING EXPENSES.

Tabulation covering sale of 4,879,973 kw-hours, 1909, with installed station capacity of 4960 kw:

| Accounts | Totals | Per kw-hour Sold |
|---|---|---|
| Rental for real estate | $225.00 | $.0000 |
| Wages, clerical labor commissions | 15,265.07 | .0031 |
| Directors allowances | 400.00 | .0001 |
| Salaries of officers | 11,750.00 | .0024 |
| General salaries | 3,904.47 | .0008 |
| " office expense | 1,918.84 | .0004 |
| Taxes | 27,697.84 | .0057 |
| Insurance | 6,318.98 | .0013 |
| Law expenses | 703.75 | .0001 |
| Claims | 28.00 | .0000 |
| Incidental expenses | 504.22 | .0001 |
| Horse-keeping | 5,200.75 | .0011 |
| Rent of poles | 18.95 | .0000 |
| Total capacity or annual service charge | $73,935.87 | .0151 |
| Wages at station | $19,570.91 | .0040 |
| Station repairs | 2,890.98 | .0006 |
| Steam plant repairs | 4,159.43 | .0008 |
| Electric plant repairs | 2,705.68 | .0006 |
| Repairs and renewals of lines | 12,398.61 | .0025 |
| Repairs: meters, lamps and motors | 3,049.31 | .0006 |
| Distribution tools and appliances | 194.10 | .0000 |
| Coal and delivery | 39,426.36 | .0081 |
| Oil and waste | 1,584.83 | .0003 |
| Water | 1,639.86 | .0003 |
| Carbons | 1,442.99 | .0003 |
| Incandescent lamps | 6,178.91 | .0013 |
| Globes | 746.39 | .0002 |
| Current bought @ 5 cents | 1,625.55 | .0003 |
| Total variable generating cost | $97,613.91 | .0200 |
| Total for all operating expenses | $171,549.78 | .0351 |
| Average annual depreciation | 79,441.67 | .0163 |
| Total annual cost | $250,991.45 | .0514 |
| Profit allowed, 5 per cent $1,472,523.06 | 73,626.15 | .0151 |
| Estimated proper revenue | $324,617.60 | .0665 |

From the above tabulation it is found that the actual cost per kw-hour for this station operated an average of 632.04 hours per year on the connected load of 7721 kw is 5.14 cents, also that the proper average price is 6.65 cents per kw-hour to yield 5 per cent on its total assets. Obviously it would be impossible without overcharging some departments and consumers and carrying others at a loss to the company to establish such a uniform rate for all service. Each consumer should pay an even profit on, and for the depreciation of, that part of the plant set apart for his use. He should also pay his share of the approximately fixed operating expenses and of the cost of the kw-hours consumed by his conected load. The question is, "How shall these items be divided among the consumers?" Shall it be in proportion to the connected load in kilowatts or shall it be in proportion to the kw-hours consumed?

If there could be storage capacity for 24 hours' use at the works, or if each consumer used the same proportion of his connected load for the same number of hours per year or day the problem would be simple and would reduce itself to the fixing of an even price per kw-hour consumed; but such is not the case.

The estimate of the cost and of the proper price for street lighting has heretofore been separately computed and would alter the figures for the whole works as follows:

| | |
|---|---|
| Whole load connected | 7,721 kw |
| Street lamps | 330 " |
| Remainder | 7,391 kw |
| Kw-hours sold whole amount | 4,879,973 kw-hours |
| For street lamps | 1,301,100 " |
| Remainder | 3,578,873 kw-hours |
| Total assets | $1,472,523.06 |
| Estimate investment in street lamps | 290,000.00 |
| Remainder | $1,182,523.06 |

This would result in an average investment of $160 per kilowatt connected load instead of $190.72 from the whole plant's assets. It is certainly fair and liberal to this company to use $190.72 per kilowatt, and as there is no opportunity to find the cost of street lighting energy separately, this latter amount ($190.72) will be used in the computation of profits. The assignment of the various items to capacity charge or kw-hours' cost is the problem which will next demand consideration and judgment.

Referring to the tabulation of operating expenses given above it might appear as if the following items are properly assignable to capacity charges:

| | |
|---|---|
| Annual service charge | $73,935.87 |
| Average annual depreciation | 79,441.67 |
| Profit allowed 5 per cent of $1,472,523.06 | 73,626.15 |
| Total capacity charges | $227,003.69 |

Dividing by 7721 kw $29.40 per kilowatt is the proper service charge against each kilowatt of capacity of each consumer, and in addition to this the cost (2 cents) of each kw-hour consumed by him.

This will be accepted as correct by all who agree with the writer as to the segregation of the items above, which leaves only $97,613.91 out of a total of $324,617.60 as variable with the kw-hours sold. Profit and depreciation can hardly be considered a function of anything else than the capacity and cost of the plant. Heretofore it has practically been shown in 12 separate cases that the depreciation per kw-hour decreases with the increase of the sales of electricity, as also do the annual service charge and the required profit. The relatively small variable generating expense is the only one that increases with the increase of sales in kw-hours.

If an attempt be made to include depreciation in the variable generating cost, the annual capacity charges are:

| | |
|---|---|
| Annual service charge | $73,935.87 |
| Profit 5 per cent, $1,472,523.06 | 73,626.15 |
| Total capacity charges | $147,562.02 |

Dividing this by 7721 kw one obtains $19.11 as the annual capacity charge per kilowatt of connected load, and for the kw-hour cost one obtains:

| | |
|---|---|
| Variable generating cost | $0.02 per kw-hour |
| Average annual depreciation | 0.0163 " " |
| Total cost electricity | 0.0363 per kw-hour |

Again the first 20 items of the tabulation, inclusive, might be by some considered as dependent upon the capacity rather than the electricity sales of the station. Then

| | |
|---|---|
| Annual service charge | $118,904.89 |
| Depreciation | 79,441.67 |
| Profit 5 per cent, $1,472,523.06 | 73,626.15 |
| Total capacity charges | $271,972.71 |

Dividing this by 7721 kw one obtains $35.22 as the annual capacity charge per kilowatt of connected load and for the kw-hour cost one obtains $52,644.89, or 1.08 cents per kw-hour variable generating cost. Further, if no capacity charges at all are made the cost of energy is 5.14 cents and the selling price 6.65 cents per kw-hour, as shown above.

Thus far the bases of three sliding scales of charges per kw-hour for consumers have been established, each of which yields to the company all of its operating expenses, its depreciation and 5 per cent on its investment, or since the depreciation is given as about 7 per cent on its taxable value a total of about 10.4 per cent on its book assets, $1,472,523.06 for profit and depreciation fund. Since from the company's point of view there would be no difference in the final results to it, the question of sliding scales at once becomes one of expediency and of the public's welfare and convenience. Since the street lighting has been separately estimated, it will be better to reckon a year as consisting of 307 work days of 10 hours each, since factories and business places which usually make up the bulk of consumers are closed on Sundays and legal holidays. Diversity factors are uncertain guesses and produce unfair discriminations.

In reiterating the statement that there is but one judicially fair method of charging, the writer would also state that opinions may widely differ as to the expediency of the assignment of the various items to capacity charge or to kw-hour cost, and so presents the three sliding scales resulting from different segregations for comparison.

The total connected load of each consumer appears to the writer the fair basis in each case, except when by special agreement the maximum measured demand is substituted.

The first sliding scale is based upon an annual capacity charge of $29.40 per kilowatt of connected load and 2 cents per kw-hour meter charge.

| Hours of Use of Full Connected Load | | | Price per kw-hour |
|---|---|---|---|
| Per Year | Per Month | Per Day | |
| 3,070 | 256 | 10 | 2.96 cts. |
| 2,763 | 230 | 9 | 3.06 " |
| 2,456 | 205 | 8 | 3.20 " |
| 2,149 | 179 | 7 | 3.37 " |
| 1,842 | 154 | 6 | 3.60 " |
| 1,533 | 128 | 5 | 3.92 " |
| 1,228 | 102 | 4 | 4.40 " |
| 921 | 77 | 3 | 5.19 " |
| 614 | 51 | 2 | 6.79 " |
| 307 | 25.6 | 1 | 11.57 " |

REMARKS—307 days' use each year. The kw-hours used each month are divided by the kilowatt capacity of the connected load to fix the hours of use and the price per kw-hour. If the connected load is not used at all, the charge will be $2.45 per kilowatt capacity per month.

The second sliding scale is based upon an annual capacity charge of $19.11 per kilowatt of connected load and 3.63 cents per kw-hour meter charges. (See first table in next column.)

The third sliding scale is based upon an annual capacity charge of $35.22 per kilowatt of connected load and 1.08 cents per kw-hour meter charges. (See second table in next column.)

Of these three interchangeable sliding scales, the writer's preference is decidedly in favor of the third for all users of motors, it being his opinion, based on practical experience, that the assignment of factors of cost is more nearly correct in it, and that the clearly proven law of demand (Fig. 3) will result in a great increase of sales and in a reduction of cost of delivery of electricity. It is true that residence customers will be forced to pay a minimum of 15 cents per 50-watt lamp per month for unused lamps. If this is regarded as a serious objection, it can be met by fixing the one-hour-a-day price for all residences and letting it go at that, as not producing a serious loss; while all other sales of electricity, particularly for long-hour motive power in manufacturing towns, will be astonishingly increased at a good profit to the company by the rates offered in the third sliding scale.

| Hours of Use of Full Connected Load | | | Price per kw-hour |
|---|---|---|---|
| Per Year | Per Month | Per Day | |
| 3,070 | 256 | 10 | 4.25 cts. |
| 2,763 | 230 | 9 | 4.32 " |
| 2,456 | 205 | 8 | 4.41 " |
| 2,149 | 179 | 7 | 4.52 " |
| 1,842 | 154 | 6 | 4.67 " |
| 1,533 | 128 | 5 | 4.88 " |
| 1,228 | 102 | 4 | 5.19 " |
| 921 | 77 | 3 | 5.70 " |
| 614 | 51 | 2 | 6.74 " |
| 307 | 25.6 | 1 | 9.85 " |

REMARKS—307 days' use each year. The kw-hours used each month are divided by the kilowatt capacity of the connected load to fix the hours of use and the price per kw-hour. If the connected load is not used at all, the charge will be $1.59 per kilowatt capacity per month.

Why does not every considerable power user in a city purchase it more cheaply from its electric light company than he can generate it himself in a smaller plant? The answer is obvious. Because the managers of most of these companies have not understood or ignore the financial laws controlling the cost and price of supplying electricity.

| Hours of Use of Full Connected Load | | | Price per kw-hour |
|---|---|---|---|
| Per Year | Per Month | Per Day | |
| 3,070 | 256 | 10 | 2.23 cts. |
| 2,763 | 239 | 9 | 2.36 " |
| 2,456 | 205 | 8 | 2.50 " |
| 2,149 | 179 | 7 | 2.72 " |
| 1,842 | 154 | 6 | 3.00 " |
| 1,533 | 128 | 5 | 3.38 " |
| 1,228 | 102 | 4 | 3.95 " |
| 921 | 77 | 3 | 4.90 " |
| 614 | 51 | 2 | 6.81 " |
| 307 | 25.6 | 1 | 12.55 " |

REMARKS—307 days' use each year. The kw-hours used each month are divided by the kilowatt capacity of the connected load to fix the hours of use and the price per kw-hour. If the connected load is not used at all, the charge will be $2.94 per kilowatt capacity per month.

## FOUNDATIONS FOR ELECTRICAL MACHINERY.

BY BRUCE PAGE.

FOUNDATIONS for electrical and all other machinery have two functions: to sustain the machine in alignment and elevation, and to absorb vibrations occasioned by the machine.

With electrical machinery the first function is the important one. It may safely be asserted that any motor, generator or electrical machine of similar type that will not run at its normal speed without excessive vibration is of faulty mechanical construction. Frequently self-contained devices, such as motor-generators and rotary converters, are not bolted to the surface on which they rest, and certain manufacturers have such confidence in their products of this type that they provide no foundation bolt holes in the bed plates.

If a machine drives through a belt or gears it must be held in accurate relation to the driven device by a foundation or other means, otherwise the belt pull or the thrust of the gears will probably move it from alignment. A foundation for such a machine should be of such proportions that the weight of the machine will not cause it to sink into the supporting bed

and that the machine will not be moved by the pull or thrust of the transmitting member.

If a foundation is necessary for a self-contained electrical machine its only duty should be to keep the machine from sinking, and if a floor or other support of sufficient strength is available no foundation should be required.

Where possible, and it usually is with small motors and generators, foundations should, except in power stations, be avoided altogether. A foundation requires floor space, and floor space represents money. Small machines, as a rule, should be carried by side walls, roof trusses or on ceilings. Occasionally it is not feasible to mount machines thus and then foundations become imperative. In Fig. 1 are shown two such cases. It was not possible to mount the motor shown at *A*, Fig. 1, overhead, because of interference with the travel of a bridge crane. If it were mounted on the side wall high enough from the floor to be out of the way, the belt drive would be too short for good operation, hence the adoption of the foundation mounting. Had it been absolutely necessary to mount the motor high on the side wall one of the patented chain drives, which operate well on very short centers, could have been installed. In Fig. 1,*B*, neither the outside wall nor roof construction was sufficiently heavy to sustain the motor and, with a belt drive, a mounting on the brick wall of the main building would not provide a sufficiently great distance

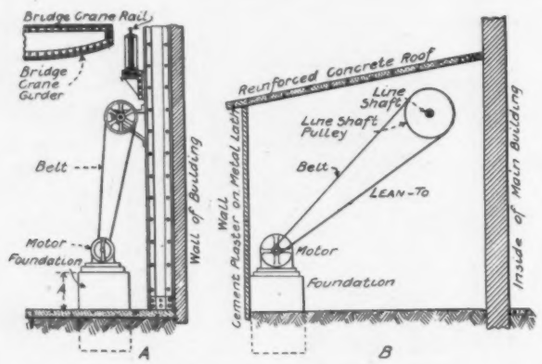


Fig. 1—Unavoidable Foundations.

from center of line shaft to center of motor shaft. The installation of a foundation appeared to be the only simple solution.

There is little definite information available regarding the rational design of foundations for any kind of machinery. The reason for this is, probably, that when a foundation for the average small machine is made of a sufficient area to include all of the foundation bolts of the machine it is to carry and of a sufficient depth to extend to good bottom or below frost line, it has enough mass to prevent thrusts or pulls in the power-transmitting members from altering its position and enough area of base to prevent its sinking. This condition is not true of certain machines of unusual shape which handle great amounts of power or have weights great in proportion to the floor space they occupy.

There are three structural conditions that must be fulfilled by a satisfactory foundation: (1) The foundation must have sufficient area of base to prevent it from sinking into the medium on which it rests. (2) It must have sufficient weight to prevent it from being shifted by belt pulls or gear thrusts, and (3) it must have sufficient weight to absorb the vibrations of the machine it carries, if there are any. The third qualification is of no importance where electrical machinery is concerned, so only the first two will be considered in the order in which they are mentioned.

For all soils there is a certain safe bearing load, and if this is exceeded the structure supported thereby is apt to sink excessively into the soil. The safe loads usually allowed in this country are given in the accompanying table.

It will be noted that the lowest value given is 1 ton per sq. ft. While the given values are doubtless safe and are used daily in the design of foundations for buildings it is considered good practice to use somewhat lower values in designing foundations for machinery. About one-half the tabulated

TABLE I—BEARING POWER OF SOILS

| Material | Bearing Power in Tons per. Sq. Ft. | |
|---|---|---|
| | Minimum | Maximum |
| Rock, hardest kind | 200 | .. |
| Rock, equal to Ashler masonry | 25 | 30 |
| Brick, equal to Ashler masonry | 15 | 20 |
| Brick of poor quality | 4 | 7 |
| Clay in thick beds, always dry | 4 | 6 |
| Clay in thick beds, moderately dry | 2 | 4 |
| Clay, soft | 1 | 2 |
| Gravel and coarse sand | 8 | 10 |
| Sand, fine and compact | 4 | 6 |
| Sand, clean and dry | 2 | 4 |
| Alluvial soils and uncertain sand | 0.5 | 1 |

values is a good working basis which allows a maximum load of about 1000 lb. per sq. ft. on ordinary alluvial soils.

The first step, then, in designing a foundation is to ascertain the total weight, including machine, fittings and the weight of

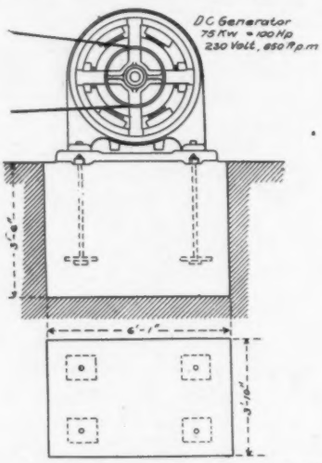


Fig. 2—Foundation Details of 75-KW Generator.

the foundation itself, that will be sustained by the soil and then to provide at least a sufficient number of square feet of area of base to bring the pressure per square foot within one-half of the values tabulated.

In Table II, in the last column, are given the pressures per square foot under the foundations shown in Figs. 2, 3, 4 and

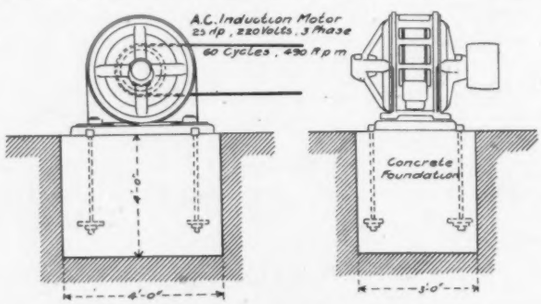


Fig. 3—Foundation for 25-HP. Motor.

5. These are all examples of foundations as erected in actual practice. It will be noted that the pressures all fall well within the safe limit. In these, as in a majority of cases in practice, the base area of the foundations was determined by that necessary to enclose the foundation bolts of the machine rather than by the safe bearing value of the soil. It is only in unusual cases, for electrical machinery, that it is necessary to compute the pressure on the supporting coil. If the foundation is made large enough to include the foundation bolts it

will usually have sufficient base area to render the pressure on the soil a safe one. Until one becomes familiar with the values of pressure that ordinarily occur he should compute each case. The base areas for unusual installations should always be computed.

The weight necessary to prevent lateral displacement is seldom computed except in the roughest way. It is usually the case that if a foundation includes the bolts and extends down

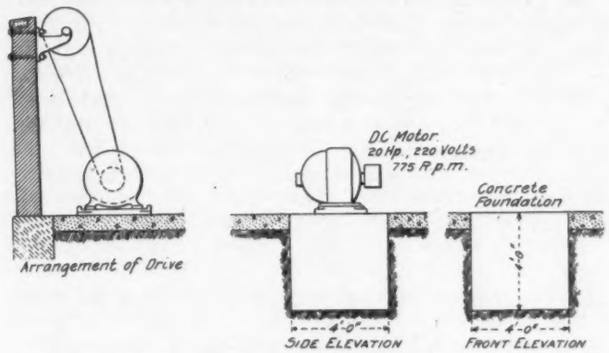


Fig. 4—Foundation for 20 HP. Motor.

to a good bottom or below the frost-line it has enough weight to prevent its shifting. That this procedure is a reasonably safe one is evidenced by the fact that failures of machine foundations, due to a shifting of their position, are rarely heard of.

The usual procedure is to design the foundation on the above basis and let it go at that. There are, as will be shown later, checks which are sanctioned by precedent which can be applied after the design is completed. So far as the writer is aware, no rational rule or equation has ever been proposed whereby the proper weight of a foundation could be computed. The only information that the writer has ever been able to obtain regarding the proper weights for foundations is given in Table III. These items refer to steam-engine foundations, but the methods that they suggest agree to some extent with designs that practice has shown to be safe. Mr. John Young, a Scotch mechanical engineer, states that foundations should

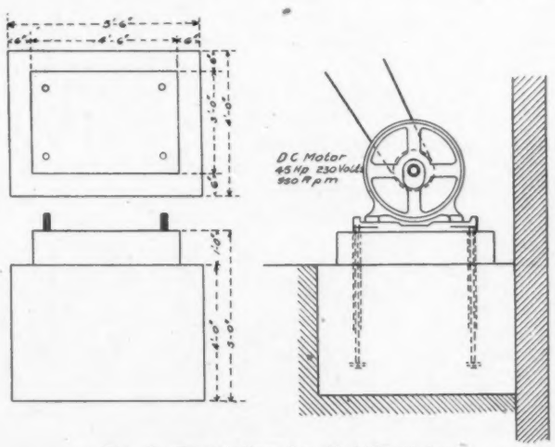


Fig. 5—Foundation for 45 HP. Motor.

weigh 2½ to 4 times as much as the engines they carry. The exact weight depends on whether the engines are of the vertical or horizontal type and on the direction of the belt pull and the speed. Mr. B. Beardsley, an American hydraulic engineer, states that the weights shown in Table II represent good practice.

These figures are said to apply, however, only to foundations on soft, shaky soils.

Neither authority takes cognizance of the speed of the supported engine. This is very important, as the tendency of belt pull or gear thrust to shift a foundation is inversely proportional, for a given horse-power, to the speed of the engine or other driver. Therefore the weight per horse-power of a foundation should, for example, be greater for a 100-hp motor running at 600 r.p.m. than for a 100-hp motor running at 1200

TABLE II—WEIGHT OF VARIOUS FOUNDATIONS.

| Hp. of Machine | Weight of Machine Pounds | Weight of Foundation, Pounds | Weight of Foundation, and Machine Pounds | Weight of Foundation, Per Hp. | Pressure in Pounds, Per Square Foot on Base of Foundation |
|---|---|---|---|---|---|
| 100 | 5,890 | 12,243 | 18,133 | 122 | 780 |
| 25 | 1,500 | 7,200 | 8,700 | 288 | 725 |
| 20 | 1,850 | 9,600 | 11,450 | 480 | 715 |
| 45 | 3,200 | 15,225 | 18,425 | 340 | 1025 |

r.p.m. It is not altogether rational to endeavor to estimate the weight for a foundation without, in some way, considering the speed of the machine it carries.

Mr. Young takes the speed of the engine directly into account, in that a low-speed engine of a given horse-power is heavier than a high-speed one of the same horse-power. It will be noted that the data in the table agree, roughly, with the results that would be obtained through an application of Young's rule. It appears that these four foundations which have not failed in service are from 2 to 5 times heavier than the machines they carry. Very likely the same ratios would approximately hold for larger units. All that is really known about the four foundations is that they have not failed.

Although Beardsley's rule does not consider speed, it furnishes a check whereby one can be sure that a foundation is sufficiently heavy. This rule is proposed for steam-engine foundations and has in practice given satisfactory results. Inasmuch as steam engines are almost invariably of slower speeds than ordinary medium-sized electrical machines (this does not, of course, apply to units that are directly connected to engines), Beardsley's rule will give safe values for generator and motor foundations. Steam engines seldom have speeds exceeding 350 r.p.m. and it is the exception for the ordinary motor or generator to have a speed as low as this.

TABLE III—WEIGHTS OF FOUNDATIONS

| HP. OF ENGINE. | POUNDS OF FOUNDATION PER HP. |
|---|---|
| Up to 25 | 300 |
| 25 to 100 | 200 |
| 100 to 500 | 175 |

The use of Beardsley's rule does not furnish a very satisfactory basis of design, for, although its user knows that a foundation designed by it will be safe, he does not know what the factor of safety is, and furthermore the rule does not take speed into consideration at all. However, it is the only usable rule that has been advocated by a practising engineer and is the only one that can be suggested until a better one is proposed. In most cases it is merely used as a check, as the weight of a foundation is ordinarily determined by the depth to good bottom or frost-line and its width and length by the positions of the foundation bolt holes in the supported machine.

The procedure, then, after having tentatively designed a foundation and having checked its area to make sure that it is sufficient to prevent settling, is to check its weight also. If the original design did not provide enough weight to meet these requirements more weight should be added, so as to entirely eliminate the possibility of foundation shifting in the most severe service.

## STEAM TURBINE TROUBLES.

In a paper read at the Cedar Point convention of the Ohio Electric Light Association, July 26, Mr. F. R. Brosius, of the Columbus Railway & Light Company, described some of the minor troubles encountered with one 1500-kw and two 500-kw steam turbines. These turbines are of the vertical-shaft type. Although trouble has arisen by reason of the failure to maintain pressure for the lubricant of the step bearing, the author expressed the opinion that the bearing as now arranged does not give as much trouble as does the average engine crank. The top, middle and bottom bearings must be kept in perfect condition and alignment and closely fitted, or trouble will be met in the machine vibrating. Other than this, it is only necessary that they be kept properly lubricated. This type of bearing must not be flooded with oil as are the bearings in the reciprocating engine. Trouble was experienced with these bearings throwing oil into the generator, but this has been overcome by fitting felt collars tight around the shaft above the middle bearings and below the top bearing. The expense for packing the pumps for maintaining the pressure in the lubricant is quite high. In three year's operation of the pumps for the 1500-kw unit, the plungers have been packed on an average of about six times per year, the rods have been packed about twice per year and the valves have been reground about twice per year.

When the 500-kw turbines were installed, each one was provided with a triplex motor-driven pump for the lubricant of the step bearings. Later a reserve hydraulic steam pump was installed, being so arranged as to boost up the pressure on the step bearings immediately in case of trouble with the motor-driven pumps. Use is made of an automatic regulator set at a pressure of about 5 lb. lower than the pressure regularly carried on the step bearings. In case either motor-driven oil pump should drop the pressure, the steam pump at once comes into action. This system has operated satisfactorily since installation.

A source of loss of economy with the vertical-type turbine, which might easily be neglected, is the carbon packing rings on the shaft for the purpose of sealing the turbine for vacuum. It is absolutely necessary that vacuum be maintained at a high point on the turbine outfit, if economy is to be expected in its operation. The carbon rings must be constantly watched and refitted to the shaft to overcome the possibility of any leaks at this point. The rings must be brought nearly to size and then scraped and spotted to the shaft, exercising a great deal more care in this work than is necessary with a bearing surface or with boxes. For this reason the water-lubricated step bearing seems preferable to the oil-lubricated bearing, as it does away with one set of carbon packing and there is no danger of air leaks from this bearing. This trouble is overcome in the latest types of horizontal turbines by mounting on the shaft a small centrifugal pump which throws a film of water around the shaft and seals the turbine for vacuum.

## THE LOW-PRESSURE STEAM TURBINE.

Mr. W. C. Anderson, of the Canton (Ohio) Electric Company, read a paper before the Ohio Electric Light Association at its annual convention held at Cedar Point, Ohio, July 26, 27 and 28, in which he related briefly experience with a 500-kw low-pressure steam turbine that has been in use for the past two years. The plant was primarily a non-condensing plant, although at a later date a turbine was installed to run condensing on well water obtained on the premises. In addition to operating in part condensing the company maintains an exhaust-steam-heating system taking the steam from the compound non-condensing engines during the winter months. During certain hours of the day and depending on weather conditions, there is either a surplus of exhaust steam or a shortage, and to regulate the heating pressure and to take advantage of every pound of steam generated by the boilers, the turbine is floated in the line all the time, taking all the exhaust steam from the reciprocating engines that is not required for supplying the heating system or heating the feed water. From midnight until morning in very cold weather or during such other hours as the load is lightest and the supply of exhaust least, the turbine is operated non-condensing, in whole or in part. Use is made of an emergency stop so that if, when the turbine is operated from exhaust steam, the load should be accidentally removed, the turbine would be stopped. The regulation is altogether by the electrical load, the turbine and the engines feeding into the same system. This plan has proven very flexible and highly satisfactory, and excellent economy is obtained at all times. To make it successful, the highest vacuum attainable must be carried. After the advent of the turbine radical changes had to be made in the design of the condensing equipment. The condenser manufacturers have responded to the demand and there are now available condensers that will maintain 28 in. of vacuum or even a higher vacuum on a turbine with less trouble than it was to maintain 26 in. of vacuum on an engine.

## MAINTENANCE OF ECONOMY IN STEAM PLANTS.

By S. A. Mehaffey.

In the writer's opinion it should not be the height of an engineer's ambition simply to have his plant running smoothly. He should watch everything, and where a little change will reduce expense or increase profit it should be made at once.

In the plant where the writer is employed as chief engineer, the station operating continuously 24 hours a day, three shifts of eight hours each, the plant had a reputation of running on 15 lb. of lignite coal per kw-hour output at the switchboard and was thought very economical. By making a great many changes on feed-water pumps, feed-water heater, feed-water regulator, resetting engine valves, getting turbine in closer regulation, getting rid of scale in boilers, and using dryer steam, in less than a year, the station is operating on less than 8½ lb. lignite coal per kw-hour on an average, and frequently has a record for 24 hours at less than 7 lb. per kw-hour.

RECAPITULATION OF POWER HOUSE REPORTS

| | April. | | May | |
|---|---|---|---|---|
| Tons of Coal used | | 182 | | 173 |
| Lignite Mine Run | 40 | | 56 | |
| Lignite Slack | 91 | | 18 | |
| Bituminous | 51 | | 99 | |
| Cost of Coal | | $491.66 | | $598.05 |
| " Labor, Oils and Waste | | 244 75 | | 256.35 |
| Gal. Water pumped | | 18,128,000 | | 18,589,000 |
| Hours arc circuit burned | | 272½ | | 266 |
| Kw-hours produced | | 40,606 | | 41,233 |
| " To Arcs | 3,134 | | 3,045 | |
| " To Commercial | 17,258 | | 17,938 | |
| " To Pumps | 20,214 | | 20,250 | |
| Cost of Coal, Labor, Oils and Waste per kw-hour | | $0.0181 | | $0.0207 |
| Lb. Coal burned per kw-hour | | 8.964 | | 8.3913 |
| Kw-hours per 1,000 Gal. Water pumped | | 1.115 | | 1.0893 |
| Lb. Coal " " " " " | | 9.994 | | 9.1430 |

The equipment consists of one four-valve, high-speed engine, direct-connected to a 75-kw National generator with belt-driven exciter, and one 100-kw Curtis steam turbine, direct-connected to generator and exciter, the turbine operating condensing. In the boiler room there are two old tubular boilers of 170 hp rating at 100-lb. pressure and one Geary water-tube boiler rated at 164 hp at 150-lb. pressure. The steam pressure carried is 138 lb. The old tubular boilers show for the month of April an average of about 8½ lb. of coal per kw-hour and the water-tube boiler shows a higher efficiency.

The city of Fort Morgan, Col., operates a combined water and light plant, doing all pumping by motors and centrifugal pumps. The average volume of water pumped is about 1,000,000 gal. per 24 hours during the sprinkling season. A report showing the results obtained for April and May, 1910, is given herewith. What has been done in this plant is not exceptional and the results can be duplicated in any first-class plant by the use of good judgment and some brain work.

# LETTERS ON PRACTICAL SUBJECTS

## PARALLEL OPERATION OF GENERATORS WITH COMMUTATING POLE

The parallel operation of direct-current compound generators having commutating poles presents some problems which are not found in machines without the interpole field. In order to explain some of the difficulties which are encountered, a brief description of the means used in paralleling simple compound dynamos will be of use.

In Fig. 1 are shown the connections for two similar generators. If the equalizer connection be omitted, when machine No. 1 begins to take more load than No. 2, more current exists in its series field coils and its voltage begins to rise. This causes it to take more current and the second machine less, and in a very short time machine No. 1 will be carrying nearly all the load. Connecting an equalizer as shown prevents this action. As the voltage of machine No. 1 rises the point *A* becomes of higher potential than *B*, a current is produced from *A* to *B* through the series field coils of machine No. 2 and the voltage of machine No. 2 is therefore increased as the potential of the first machine builds up. The load divides equally between the two, provided the series field coils are so adjusted by means of the German

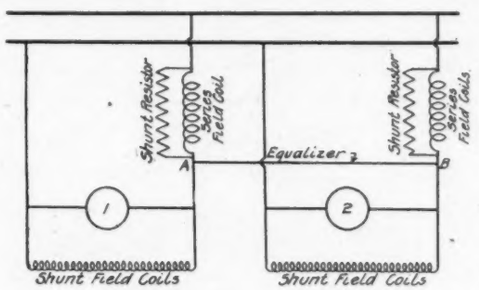


Fig. 1—Parallel Connection of Plain Compound-Wound Generators.

silver shunts that a definite increase of current produces the same rise in voltage in each of the machines.

Consider now two interpole machines connected as in Fig. 2. Suppose that, in a manner which is to be explained later, the interpole field m.m.f. acts with the series field m.m.f. to raise the voltage as the load comes on. If machine No. 1 begins to take more than its share of the load, an equalizing current is produced from *A* to *B* as before. This current exists only through the series field coils of machine No. 2 and does not pass through its commutating field coils. Therefore, the voltage of machine No. 1 will rise faster than that of No. 2, due to the compounding effect of the unbalanced current in its interpole field coils. As a result, the first machine takes all of the load and the generators will not operate in parallel. As a definite instance the following case is stated.

Two 375-kw generators giving 225 volts at no load, and 250 volts at full load, were installed in a certain power plant. Either machine, when operated alone, compounded correctly with good commutation. When both machines were joined to the busses one would begin taking far more current than its share until its circuit breaker opened; it was impossible to load them together.

Measurements of the resistances of the series field coils of the machines showed them to be equal; the German silver shunts were found to be identical. It was noticed, however, that nearly 40 per cent of the load current was being shunted from the series field coils. The interpole field coils and shunts were not exactly equal.

By means of a voltmeter connected to indicate the e.m.f. between commutator bars at the point of commutation it was ascertained that the brushes were set back of the full-load neutral point; that is, in a direction against the rotation from the neutral point. When the brushes were shifted forward from the neutral point the full-load voltage dropped greatly. Instead of compounding from 225 volts to 250 volts the machine voltage fell from 225 to 220. The heavy shunt resistor was disconnected from the series field coils and the interpole field was weakened considerably by shunting more current from it. The machine then compounded from 225 volts to 257 volts

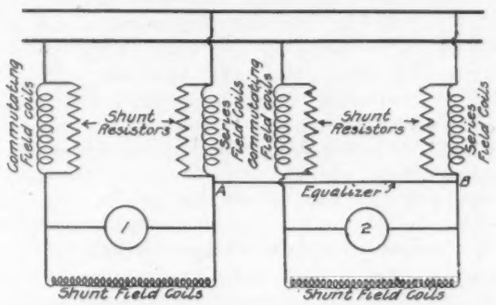


Fig. 2—Parallel Connection of Compound-Wound Interpole Generators.

and a small amount of current shunted from its series field coils brought the full-load voltage down to the correct value.

When the changes had been made on both machines they worked perfectly in parallel and the commutation was excellent.

The manner in which the interpole field affected the compounding is indicated in Fig. 3. At the top is shown the field structure and below this are the field forms produced by, first, the main poles; second, the commutating poles, and, third, the armature m.m.f. The shaded area is the resultant full-load field form, and under this is a diagrammatic representation of the armature coils and brushes.

The voltage between brushes *c* and *d*, among other things, is proportional to the number of magnetic lines cut per second by the conductor between the brushes. It will be noted that when the brushes are set at the point *a* the interpole field is of the right polarity to add its flux to that of the main field and increase the voltage generated between *c* and *d*. On the other hand, when commutation occurs at *b*, the interpole flux tends to produce a voltage counter to that produced by the main field. In the case previously cited, with the brushes at *a*, the interpole and series field fluxes caused a rise in e.m.f. from 225 volts to 250 volts, while with the same field strength and the brushes at *b* the interpole field reduced the e.m.f. from 225 volts to 220

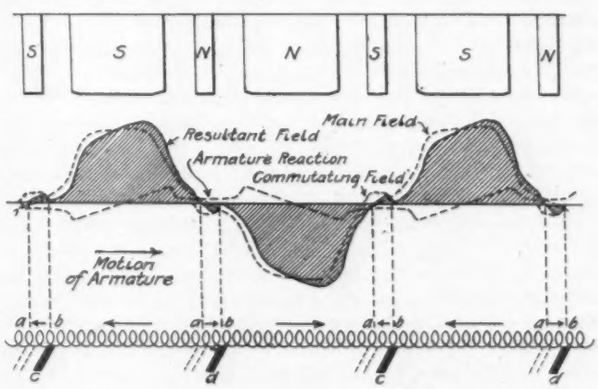


Fig. 3—Components of Field Magnetism.

volts in opposition to the compounding effect of the series field coil m.m.f.

Thus, for parallel operation of compound interpole machines, it would seem that the best results will be obtained when the brushes are shifted slightly ahead of the full-load neutral point and the series field m.m.f. is of sufficient strength to give correct compounding.

*Schenectady, N. Y.* BAYSE N. WESTCOTT.

### SHUNT-WOUND MOTOR ON CIRCUITS OF VARIABLE VOLTAGE.

It is well known that shunt-wound motors do not operate satisfactorily when supplied with energy from circuits whose voltage is subjected to sudden and wide variations, such as are often found on railway circuits. Series-wound motors are not seriously affected by such variations in the supply circuit. A sudden rise in voltage, on a circuit from which a shunt-wound motor is receiving energy, causes severe sparking at the brushes, and very often operates the circuit-breaker or other protective device. However, the opening of the circuit-breaker or blowing of a fuse in the supply circuit is no remedy for sparking at the brushes. This sparking seems to be of a kind that is particularly destructive to commutators. Shunt-wound motors find considerable use in the terminals and repair shops of electric railways, and they are usually supplied with energy from the railway circuit. The device described below is designed to enable the motors to run without sparking, despite the widely varying voltage of the railway circuit.

This device, which is in reality a special type of choke coil, was designed to protect the motors in the terminals of one of New York's large electric railways. The motors in question are compound wound and are used to operate elevators. They start as series-wound machines, a 4000-ohm resistor being connected in series with the shunt-field circuit. As soon as running speed is reached the resistor is automatically shunted and the series field is cut out of circuit. The motor then operates as a straight shunt-wound machine. The nearest feeder taps the third-rail at a point over 4000 ft. away from the terminal, and when a train pulls out there is a large and sudden drop in voltage. On passing over the yard switches before reaching the main line, the controller is thrown to the off position with the result that the voltage instantly rises again.

It is this rise in voltage that causes the trouble, very often causing the circuit-breaker to open and stopping an elevator between floors. Not only does the circuit-breaker open, but every time one of these voltage surges comes in, there is a sharp spit of fire from the brushes. If the voltage rise is very large, sparks sometimes jump from the positive brush holder to the motor frame, a distance of almost 2 in. These voltage surges often cause a motor to flash over and rapidly burn out commutators. It was found necessary to replace several commutators, the insulation between the commutator and the shaft being completely destroyed.

The shunt motor, when looked at from the theoretical side, resolves itself into a divided circuit, one branch of which has a very high resistance and a high reactance, and the other a very low resistance and low reactance. The instantaneous voltage change in a circuit of this kind does not follow the change in the supply circuit directly, but in the low reactance part of the circuit amounts to four or five times the variation, and in extreme cases it may be seven or more times as great. The reason the circuit-breaker or fuse in the supply line fails to protect the motor from the voltage surge, even when it opens, is that the trouble is inherent with the motor itself and is always encountered in circuits of this type.

Assume, for example, a drop in the supply voltage of 10 per cent, or from 600 to 540 and then a return to 600; the instantaneous voltage on the fall will be considerably below 540, but this will not cause any trouble. On the rise the instantaneous e.m.f. may reach 300 volts or more, thereby bringing the total voltage across the armature terminals up to 800 volts or 900 volts for an instant. This is what causes the trouble, and produces the sparking at the brushes. If the change in the supply voltage amounts to 100 volts or 120 volts, which was very often the case in this railway terminal, the total momentary voltage across the armature may easily be 1200 volts, or even higher.

A number of tests were made on one elevator motor and it was found that no matter how heavy the surge no effect whatsoever was produced as long as the motor was operating as a series machine. The effect was only produced when the motor was operating as a shunt machine, which bears out the theory of a divided circuit. A number of tests were made on a 220-volt shunt motor at the laboratories of the Polytechnic Institute of Brooklyn. The tests consisted of placing choke coils of different sizes in series with the motor armature and then switching the motor directly from the 110-volt circuit to the 220-volt supply main. From the results obtained from a large number of tests a coil was designed that would permit of switching the motor at full load from the 110-volt to the 220-volt circuit without producing even the slightest trace of sparking at the brushes.

A coil was then built and placed between one of the armature terminals and the line of one of the elevator motors at the railway terminal. This coil has a very low resistance, and was placed in service during December, 1909. With the device in circuit the circuit-breaker never opened nor was there the slightest trace of sparking even with the heaviest surges. The coil does the work satisfactorily; it contains no moving parts, and has a very small resistance, giving an $I^2R$ loss of very few watts. These coils are positive in their action, and form very simple and reliable means of satisfactory operating shunt motors on circuits where the supply voltage varies widely. The efficiency of a motor with one of these coils in circuit is not reduced by more than 1 per cent, but this is more than compensated for by the increased reliability of operation and by the increased life of the commutator. There is no reason why these coils cannot be designed for use with any size of shunt motor or to meet any change in voltage.

*Brooklyn, N. Y.* Wm. B. Kouwenhoven.

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### HIGH TENSION TERMINAL CONSTRUCTION AND TEMPORARY STACK GUYING

In the July number the writer described an overhanging retaining wall for coal storage erected at the power house of the Indiana & Michigan Electric Company at South Bend, Ind. There are several other interesting features connected with the station under discussion which are worthy of emulation. Provision has been made for five high-tension circuits of three wires each, some of which are in use now. To accommodate them there was constructed during the past season the very strong terminal arrangement illustrated in Fig. 1. This, as one

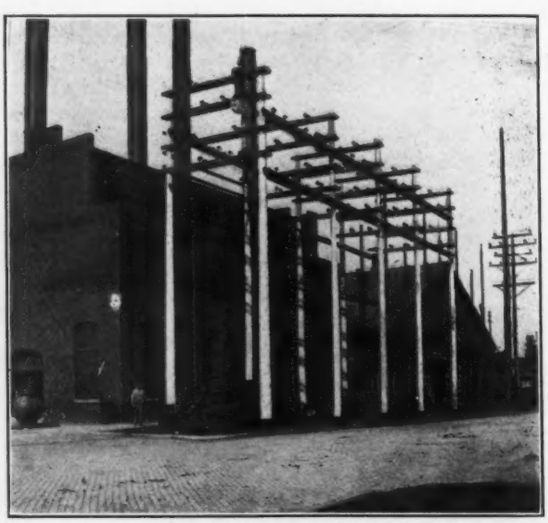

Fig. 1—High Tension Terminal Construction.

of the operators has expressed it, is heavy enough so that if a fire breaks out on it, it will not burn through and let the wires drop until the station attendants have a chance to locate and cut out the defective circuit. Due credit must be given to the mechanics who erected this high-tension terminal arrangement, as well as to the designer of the same, for it is as pretty a piece of pole and cross-arm work as it has been the writer's lot to see. Every line is straight and square to the other lines,

both in the pole and the cross-arm work. The poles are evidently selected ones, for they are also straight and symmetrical. The cross-arm work is all double, as are also the stringers which connect the poles lengthwise of the lines. The insulation is also in duplicate, each double cross-arm also being attached by a separate insulator to the wires supported by it. Three of the four high-tension lines come from the hydroelectric power house at Berrian Falls and are under a tension of 25,000 volts each. The fourth line is for outgoing service and supplies the local street railway demands. This line is operated under 14,000 volts. The handling of the high-tension current is effected by means of remote-control switches and motor-operated steam valves are to be installed in the pipe connections of the steam turbine unit when the new building is completed. Immediately in front of the door, in Fig. 1, will be noted one of the very large atmospheric turbine valves which is to be installed in the new arrangement of the station. A good idea can be obtained as to the dimensions of the turbine which requires a valve like this by comparing it with the two steel oil barrels standing in the same focal plane with the valve. The man was also about the same distance from the camera as the valve. There are many interesting engineering problems in evidence in connection with the rearrangement of this station, and an interesting, although not very important one, is the handling of the guy cables from the four stacks now in evidence at this station. A number of the guy cables were attached to the walls and roof of the old building, which is shown in the distance by Fig. 1. Incidentally, the new steel posts and some other structural work are shown projecting through the pitch roof of the old building. The four large stacks are also shown in the upper left corner of Fig. 1, and all the north-side guys had to be removed from the old building, temporarily only, as the guys can be replaced upon the walls and roof of the new structure after its completion. What to do with these guys was a problem, for a busy street passed close along that side of the buildings and the company had no rights upon the property immediately opposite on the other side of the street. As the heavy stacks needed both middle and top guys, there would be four double sets of guy cables— eight in all to be taken care of. After a good bit of figuring by the engineers, they hit upon the plan which was adopted and the single heavy pole shown at the extreme right of Fig. 1 was erected and all of the eight stack guys were connected thereto. The guys in their new position are far above the high-tension circuits, so high above ground, in fact, that the middle guys appear to run horizontally to the stacks. It may well be imagined how interesting a matter it must have proved to engineer each of these eight wire cables to its new position and to make it fast to the pole without making contact with the high-tension wires. To be sure, the guard wires helped the matter a good deal, but while guard wires prevent falling wires from making contact with the high-tension work, a lineman is never fond of trusting to guard wires when he is running heavy wire cables above and crosswise of said guard wires and high-tension circuits. But the work of the linemen and the engineers did not consist merely of placing the eight stack guys upon the pole as noted. The pole required very heavy guying in turn to withstand the pull of the stacks, and permission was finally obtained from owners of the opposite property to place a stub pole on that side of the street. This was done, as shown by Fig. 2, a heavy 18-in. pole being placed just inside the fence and attached to the guy pole by means of two ½-in. steel-wire cables. Thus the stacks were adequately guyed and no portion of the guy wires or braces was less than 20 ft. above the curb. The pole guy crossed one sidewalk at a less height, but that did not matter as the farmers kept their loads of hay well away from sidewalks and the adjacent mud gutters when coming into town. Fig. 2 also shows a side elevation of a portion of the high-tension terminal, and the method of arranging the double cross-arms and insulators can be seen from another angle than that presented by Fig. 1. Incidentally, the four large stacks are shown by Fig. 2 and the location of the old building, which is being replaced by a new one. Portions of the steel framework for the new building are shown projecting through the roof of the old structure. The new building is to be built to the height of the roof shown in the distance, beyond and above the pitch-roof building, which is to be demolished. Incidentally it may be remarked that the line wires visible in the upper portion of Fig. 2 are all circuits supplied with energy from this station, and are only about one-half of the circuits which leave the building, just as many more wires running toward the east and crossing the St. Joseph River upon the long-distance wire-carrying device illustrated and described in the November, 1909, issue.

*South Bend, Ind.* JAMES F. HOBART.

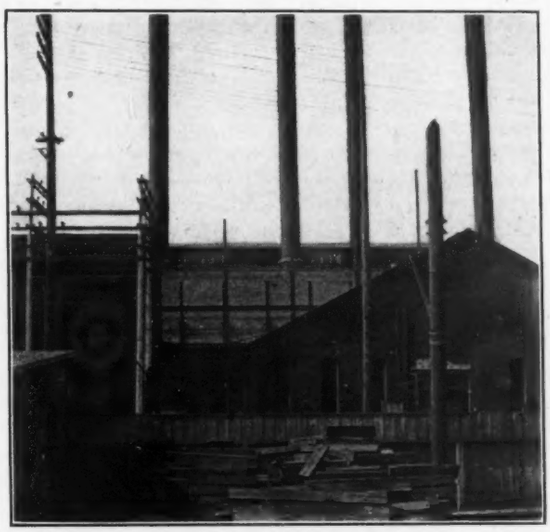

Fig. 2—Temporary Stack Guying.

### CONNECTING TRANSFORMERS OF DIFFERENT SECONDARY VOLTAGES IN PARALLEL.

The following problem on paralleling a bank of three transformers with a bank of three other transformers and the solution suggested will doubtless be of interest. It was desired to parallel three 75-kw transformers with three 30-kw transformers on a three-phase, 60-cycle system, the connections on primary and secondary to be in delta. The primary voltage is 2200 on both banks of transformers; but the secondary voltage of the larger bank is 488, while that of the small bank is 460. In studying this problem various questions presented themselves. What would be the effect of paralleling them as they are? Would it be necessary to employ a reactance, and if so how many amperes would it have to be wound for? How many volts would it have to take up, the ratio of the larger bank being 4.5 to 1? Would the reactance have to be connected in series with each line or in one leg of each transformer on the primary of the larger set? These questions could not be answered off hand and the problem was referred to an engineer who suggested the following solution:

The division of load between two transformers in parallel depends almost exclusively upon the voltage regulation of the two units, that is, upon the relative impedances of the two transformers. Even two 30-kw transformers would not divide the load between them equally unless the impedance of one transformer was equal to that of the other, both in their reactive components and their resistance components. A 30-kw transformer would operate satisfactorily in parallel with a 75-kw transformer, provided the impedance of the smaller transformer were larger than that of the larger transformer in the ratio of 75 to 30; that is to say, the voltage regulation under load of the one transformer should be identical with that of the other, in which event the two transformers will divide the load in proportion to their ratings. The above relations exist when the two transformers are designed for identical primary and secondary voltages. When the ratio of transformation of one

transformer is different from that of the other, it is evident that even at no load a certain amount of current will exist in their circuits when both the primary and secondary coils are joined in parallel. In the case just cited, where one transformer has a secondary e.m.f. of 460 volts and the other of 488 volts, when the two transformers are connected in parallel there will be produced a local circulating current which will have a value represented by 28 volts, divided by the sum of the impedances of the two transformers. It may be stated, with a fair degree of accuracy, that this amount of current will exist at all times in the transformers quite independent of the load which each may be carrying. Under load conditions this current will merely be superposed upon the load current. It may be in a direction to be additive with reference to one load current and subtractive with reference to the other; but probably would be largely in time-quadrature with each of these currents, and hence would add at right angles to each one. The 75-kw transformer could be parallel with the 30-kw transformer, and the local circulating current could be kept within proper limits by inserting an impedance between the two transformers. However, if this method were carried out in its simplest form the results would not be highly satisfactory. By far the best method of operating in parallel two transformers which give different secondary e.m.fs. is to place between them a so-called auto-transformer wound for an e.m.f. equal to the difference between the two secondary voltages, and for a current equal to the maximum current which either one of the

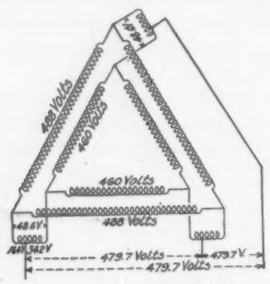


Diagram of Connections.

transformers will be called upon to carry under load conditions. In case three transformers of 75-kw rating are to be operated in parallel with three transformers rated at 30 kw each, it is preferable to use three separate auto-transformers and make such connections to these transformers that the load will divide according to the ratio of the ratings of the several transformers. The proper method of connecting the secondary circuits of the transformers is indicated in the accompanying illustrations. The secondaries of the 75-kw transformers should be joined in delta so as to produce 488 volts between the adjacent wires. The secondaries of the 30-kw transformers should be similarly connected so as to produce 460 volts between the wires. Between the apex of each voltage triangle, that is, between the terminal points of the transformer loads, there should be jointed an auto-transformer wound for 48.6 volts, as indicated in the illustration. By tapping this transformer at an intermediate point located at each place along the winding so as to produce 14.4 volts on one side and 34.2 volts on the other side, the division of load between the 30-kw set and the 75-kw set can be absolutely guaranteed to be in proportion to the ratio of the ratings of these transformers. The active ampere-turns in each section of the auto-transformer is definitely set, so that when the 75-kw set is loaded to 26.8 amp (which means its full load current) the other set will be carrying 11.3 amp, which is its full load output. The e.m.f. between the tapping points on the three auto-transformers will be 479.7 volts at no load and the percentage regulation will be a mean proportion between the regulations on the two transformer sets. An auto-transformer is a single-coil transformer, or is operated as a single-coil transformer. It can be designed with a wire of uniform cross-section, but this is not necessary. It can be designed as a two-coil transformer, one coil being proportioned for 11.3 amp and the turns arranged for 34.2 volts, and the other coil could be designed for 26.8 amp and with turns sufficient for 14.4 volts. These two coils could then be connected in series giving 48.6 volts, and the output current at the tapping point would be 38.1 amp. In each case the small value of the exciting current, which in any event is truly negligible, has been ignored.

*New York.* Harvey Dunlop.

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### COMMUTATOR TROUBLES.

Owing to the substitution of mica compounds for mica itself in the manufacture of commutators very many commutator troubles arise which are directly traceable to this cause. Of these the most frequent is pitting, especially on railway motors. By undercutting or grooving the commutators, railway companies have been enabled to get rid of a large percentage of these troubles and to secure a much longer life of the commutator. The best micanite plates obtainable are usually composed of the finest selected soft white Indian mica in conjunction with a shellac solution made from the finest shellac. The sheets are subjected to enormous pressure which gets rid of almost all of the shellac solution, leaving just enough for producing the sheet, which when in the commutator will not swell or ooze. This is cut up into sections or punched to any desired pattern. A different grade of mica is chosen for turbo-generators and large machines. However, the best micanite is liable to show weak spots and when these are right on the commutator surface, pitting usually results. Bad pitting is due to inferior micanite, the better grade of material only developing small pits. In not a few cases the cause of the latter in railway service is a flash over. When pitting occurs the usual procedure is to apply commutator dressings, etc., and when these fail to effect a remedy, as they always do, sand papering the commutator is tried, with about the same results. The only remedy is to get rid of the pits. To do this they should be cleaned out by scraping until clean mica shows itself. Numerous mixtures may then be applied. A thick mixture of powdered mica and shellac varnish will serve as a temporary filling, or a mixture of plaster of paris and an insulating varnish. A putty made up of water glass and powdered mica if carefully applied will also answer. The putty must be of the right consistency, neither too sticky nor too dry, and in applying it care must be exercised not to entrain any air. This mixture expands as soon as the commutator heats and usually holds for a number of years if well done.

Closely akin to commutator troubles are troubles with collector rings on alternating-current machinery. For a number of years a large railway company was troubled with the copper brushes on its rotary converters. The brushes cut grooves in the rings and if the rings were not turned down, splinters from them would fall across adjacent rings and short-circuit the rotary, despite the precautions taken in cleaning the machines and blowing out the dust and other accumulation with compressed air. The copper dust from the brushes and rings also caused short circuits at times. Carbon brushes were then substituted for the copper brushes on the collector rings and proved to be quite desirable, although quite a departure, at the time, from standard practice.

Where commutators are grooved as in street-railway work, it will usually be found advisable to employ a high-grade brush and a lower brush tension, thus reducing the wear on the commutator to a minimum. A treated brush will not always give satisfactory results, because the dust given off by the wear of the brush adheres and accumulates in the slots, eventually causing a short circuit. Treated brushes, moreover, have a tendency to become gummy and to stick in the brush holder. Many of the high-grade imported brushes have so little effect on the commutator and the wear on the latter is so slight as to indicate a life of many years. In shutting down generators, it is a good rule to clean off all oil and lubrication from the commutator so that when the latter becomes cold on standing, the oil does not harden and injure the commutator.

*Philadelphia, Pa.* Scott Thorne.

# QUESTIONS AND ANSWERS

We have a 75-kw, 110-volt direct-current generator feeding a lamp circuit and a motor circuit in a sawmill. In addition to the five motors ranging in rating from 1 hp to 5 hp, there is in use a home-made 8-ton electric crane equipped with two series and one compound-wound motor, rated at 3.75, 20 and 8 hp, respectively. The crane operates on a 600-ft. track and has a 40-ft. trolley track. Everything is in the open, and at present there are two trolley wires strung on poles. On account of trouble from short-circuits, we wish to eliminate one of these wires. Could the negative be grounded to the rails? The frames of the two series-wound motors have no connection to the ground. P. N. F.

The method of grounding proposed by you for your 110-volt system will give satisfactory results. The only precaution that need be observed is to assure yourself that all electrical circuits not intended to be grounded are kept well insulated.

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We have two motors we are at a loss to know what to do with. Both are single-phase machines designed for 60 cycles and 110 volts. They will not run unless started by hand and until they heat up, after which they will operate satisfactorily. The motors have three binding posts. Kindly advise us on the operation of these machines. J. P. C.

The ordinary type of single-phase induction motor is not self-starting from rest, and some auxiliary starting device must be employed with such machines. It is probable that the 60-cycle machine which you are using was designed as a split-phase motor, and in order to render it self-starting it will be necessary for you to use a resistance in series with the third lead on the machine. In this case the machine will exert a weak starting torque and will accelerate to full speed without load.

---

We possess some three-phase induction motors with wound rotors and internal grid resistance. Owing to the dusty surrounding in which these motors operate, we wish to arrange them to start with an auto-starter. Can you suggest a way to arrange for this method of starting which will cut out the internal resistance? E. A. J.

From your inquiry we are led to believe that the auto-starter which you expect to install in connection with certain three-phase induction motors is of the auto-transformer type. When use is made of a starter of this type it is unnecessary to vary the resistance in the secondary circuit of the induction motor unless the starting conditions are so extreme that an enormous value of starting torque is required. Assuming that a moderate value of starting torque will suffice in your equipments, it should be possible for you to short-circuit the rotor leads upon themselves and convert your machines into the equivalent of squirrel-cage-wound induction motors.

---

There are in use in our city lighting plant eight direct-current, 9.6 amp, 80-light Wood arc machines which are in good operative condition. Would rewinding these machines for lower amperage, say 6.6 amp or less, increase or decrease the efficiency of the machines? If street series tungsten lamps were used on these circuits, would not the 9.6 amp lamp, in view of its large filament, be stronger and give a better light than one of lower amperage? Considered from every point of view, especially total unkeep and results obtained, is the low-voltage series tungsten street lamp the most practical street-lighting unit?

It is possible to rewind a 9.6-amp arc machine to, say, a 6.6-amp machine without materially affecting the efficiency. In your case it is probable that it would prove advantageous not to rewind the machine, but rather to obtain series lamps, which can be operated at the larger value of current. Tungsten lamps can be obtained for 7.5 amp which are said to give excellent results, and doubtless by communicating with any of the lamp manufacturers you will be able to obtain estimates of the cost of 9.6-amp lamps, which should prove even more satisfactory than the 7.5-amp units.

---

What is the voltage between the two outside wires of a two-phase, three-wire circuit used for motor service? How should a two-phase motor having four binding posts be connected to such a circuit? W. F.

The voltage between the two outer wires of a two-phase, three-wire system is 1.4 times that between the two adjacent wires. That is to say, if the e.m.f. per phase is 110 volts, the e.m.f. between the two outer wires of a three-wire, two-phase system would be 155 volts. In connecting a two-phase motor to a three-wire, two-phase system the inner wire should be treated as merely a common wire for the two phases. That is to say, one of the phase windings should be connected between the inner wire and one of the outside wires, while the other phase winding should be connected to the inner wire and the remaining outside wire. It might be well in this connection to call your attention to the fact that if, when connected, the motor tends to revolve in the opposite direction from that desired, it will be necessary merely to interchange the connections of the two leads of one of the phase windings on the machine.

---

What formula is used in calculating a single-phase starting winding—that is, the relation between the turns in the running winding to those in the starting winding? How many degrees is the starting winding connected in advance of the running winding, and what relation should the number of slots in the rotor have to those in the stator of a squirrel-cage machine? C. A. D.

The single-phase induction motor found upon the market today usually consists of either a symmetrically wound three-phase motor or an unsymmetrically wound two-phase machine. The windings of the three-phase motor are identical in every respect to the windings of the ordinary three-phase induction motor, but for the purpose of starting the machine from rest use is made of resistance connected in series with reactance, the two being joined across the main leads of the supply system. The third lead of the motor is drawn to the point of connection between the resistance and reactance. In the two-phase type of machine one of the windings contains considerably more coils than the other. A popular arrangement consists in using about three times as many turns in the main winding as in the starting winding. Under starting conditions the resistance is connected in series with the starting winding; this circuit then being joined in parallel with the main supply system. Under running conditions the resistance circuit is open, and no current exists in either the starting resistance or in the auxiliary starting winding.

---

What is the advantage of setting three single-phase transformers for a three-phase motor circuit instead of two transformers? How may the rating of the transformers necessary in either case be calculated? G. F. S.

A complete discussion of the relative advantages and disadvantages of polyphase transformation by means of single-phase and polyphase transformers was given in our issue for February, 1907. In transforming from three phase to three phase use may be made of either one three-phase transformer, two single-phase transformers or three single-phase transformers. As a specific example, it may be stated that for the transformation of a total amount of power of 15 kw there could be used either a single 15-kw three-phase transformer; three 5-kw single-phase transformers connected either in delta or star; or two 8.66-kw transformers V-connected, or one 7.5-kw combined with one 8.66-kw transformers T-connected. So far as cost and performance are concerned, the most desirable equipment is the single three-phase transformer. Almost equal to this in performance, but slightly more costly, would be the three single-phase transformers. The most disadvantageous arrangement is that employing two V-connected transformers. Where it is desirable to use two transformers rather than three, it is preferable to connect both the primaries and secondaries according to the T-method. When this connection is used the phase relations are much better balanced than is true with the V-connections.

# Central Station

## Management, Policies and Commercial Methods

### ABANDONMENT OF CONEY ISLAND AMUSEMENT PARK ISOLATED PLANT.

Steeplechase Park, one of the largest Coney Island amusement enterprises, and known all over the world, has just discontinued the use of its 1200-hp private plant and closed a contract with the Edison Electric Illuminating Company of Brooklyn for its supply of electrical energy. The Steeplechase plant was the largest isolated plant on Coney Island and for years was used by its proprietor as a show place. Fire destroyed the

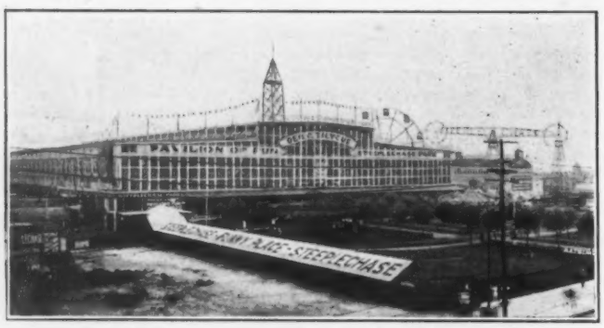



Fig. 1—Steeplechase Park.

park a few years ago and the power plant was not fixed up for exhibition purposes again. The acquisition of this load virtually places all of Coney Island on the Edison circuits.

The Edison Electric Illuminating Company of Brooklyn by reason of the immense lighting load at Coney Island, occupies a rather enviable position. While the load on other central stations usually drops during the summer season, that of the Brooklyn Edison increases, in so much so that the peak load which everywhere else is reached in the winter comes on in the summer on the Brooklyn system, giving it a yearly load factor of no mean proportions. Moreover, the peak lighting load at

Fig. 2—Abandoned Isolated Plant.

Coney Island differs from the ordinary residence lighting peak, and can scarcely be called a peak since it has a duration of from four to five hours.

Mr. Tilyou, the proprietor of Steeplechase Park, found after much experience that the cost of running his isolated plant during the summer and keeping it idle during the winter was not commensurate with its importance as an attraction. The Edison substation in Dreamland was by far a more attractive place. Moreover, the service obtained from the plant was not the best. There were times when the lights flickered and other times when the engines broke down. Over 14 tons of coal were carted daily to the plant, and the six separate generating units were a source of worry during the busy season. The large amount of space taken up by the plant could also be utilized for other and more profitable purposes. These considerations, coupled with the fact that the Edison Electric Illuminating Company of Brooklyn could supply him with energy at less cost than he could make it, induced Mr. Tilyou to make the change. The demand is 800 kw.

### CENTRAL-STATION CONSTRUCTION COSTS AT SALEM, MASS.

In connection with a petition filed recently with the Massachusetts Gas & Electric Light Commission for approval of a new issue of capital stock, the Salem Electric Lighting Company filed with the board an unusually complete statement of its expenditures for plant construction and improvements during the past nine years. Those expenditures reached a total of $363,762, and were classified under real estate, steam plant,

CONSTRUCTION COSTS.

| | |
|---|---|
| Cost of work | $3,587 |
| Two engines, 400 and 600 kw, floor, 62x38 ft | 1,370 |
| Two boilers, floor, 51x30 ft | 321 |
| Concrete coal run, 19x10 ft. in boiler house | 102 |
| Iron stairs leading from engine to switchboard room | 682 |
| Cutting out boiler house door | 17 |
| Painting switchboard room | 9 |
| Concrete floor around 1000 kw engine, floor, 44x35 ft | 875 |
| Boiler house extension, 56x55 ft., one story high, concrete roof and fireproof construction throughout | 7,255 |
| Wooden shed, 60x16 ft., height 12 ft | 232 |
| Coal run. This run is composed of chestnut standards about 30 ft. high, on top of which is a platform for unloading and conveying by barrows the coal supply for the station from vessels. Length of run, 165 ft. | |
| Cost of run | 447 |

STEAM PLANT MACHINERY COSTS, SALEM, MASS.

| | |
|---|---|
| One 400-kw McIntosh & Seymour vertical engine | $17,268 |
| " 600 " " " " " " " | 20,105 |
| Erecting above engines | 679 |
| Barr pump and condenser | 1,969 |
| One 1000-kw vertical cross-compound engine | 25,267 |
| One 1200-hp feed water heater | 663 |
| One 350-hp B & W boiler with superheater, less grates | 4,419 |
| Warren feed pump, 14x12 in. end suction, rubber valve | 440 |
| One special National feed water heater | 1,130 |
| Four 350-hp B & W boilers | 18,880 |
| One 10x10x12-in. single tank pump | 256 |
| One vacuum pump for Worthington condenser | 1,300 |
| Piping for engines, pumps, boilers, exhaust, feed water, heater and condenser | 32,662 |
| Foundations for 400, 600 and 1000-kw engines | 8,426 |
| " " boilers and pumps | 5,880 |
| Engineering and freight | 600 |

electric plant, overhead system, underground system, transformers, meters, arc and Nernst lamps. A brief outline of these expenditures was given in connection with an account of the hearing held by the board on June 15. In the following paragraphs are given a number of selected items from the company's list of expenditures which are suggestive in a general way as to the cost of carrying out definite work in the field. Only such items are printed as are specific in their interest as cost data, omitting cents:

#### ADDITIONS TO POWER STATION.

This work consisted of the building of two stories on the east end of the station, 60 ft. long and 14 ft. wide, consisting of two floors, both of concrete, the lower room being used for station auxiliaries and apparatus connected with the switchboard in the room above. The upper room contains the com-

plete switchboard, and is provided with fire shutters on doors and windows, with concrete roof.

As stated, these figures are correct to the nearest dollar unit, and include but a portion of the total expenditures filed by the company. Only such items were selected as might be sufficiently complete to be of general interest.

APPROXIMATE DETAILED COSTS OF ACCESSORIES (PARTIAL LIST).

| | |
|---|---|
| Pipe covering | $1,534 |
| Boiler grates | 2,057 |
| Pipe supports, platforms and erection | 977 |
| Oil shields for engine units | 462 |
| One No. 10 steam separator | 270 |
| Rochester lubricator | 43 |
| Gauge boards for 400 and 600 kw sets | 102 |
| Gauge board and gauges, 1200 kw engine | 68 |
| Relief valve for heater piping | 16 |
| One single cylinder tank pump | 215 |
| One 1-qt. lubricator | 26 |
| Screen in front of canal to condenser | 129 |
| Valve, Warren feed pump | 26 |
| Steam pressure regulator | 50 |
| One American unit oil filter | 107 |
| Damper regulator | 80 |
| Water meters on boiler feed piping | 260 |
| Washing machine for waste reclamation | 143 |
| Oil tank, Barr condenser | 13 |
| Canal, 10x6x8 ft., connecting condenser tank with river | 500 |
| Cutting hole in chimney for boiler flue | 16 |

ELECTRIC PLANT PARTIAL LIST OF SELECTED COSTS (TO NEAREST DOLLAR).

| | | | |
|---|---|---|---|
| *Switchboard.* | | | |
| Twenty panels, 56 ft. long, blue Vermont marble 2 in. thick | | | $11,500 |
| Circuit breaker | | | 200 |
| Oil switches | | | 460 |
| Exciter rheostat | | | 248 |
| Addition to switchboard, completing panels 3 and 16 | | | 3,000 |
| *Wiring for Switchboard.* | | | |
| Cleats | $14.40 | | |
| Hollow brick pipe | 91.20 | | |
| Labor installing brick pipe | 65.74 | | |
| Rubber covered wire | 97.63 | | |
| Wire, etc | 111.84 | | |
| Moulding | 43.75 | | |
| Labor, etc | 7.09 | | |
| Cable | 179.27 | total | $611 |
| *Machinery costs.* | | | |
| One 150-hp motor | | | $3,600 |
| Compensator | | | 235 |
| One 40-kw 125-volt exciter | | | 2,650 |
| Two 200-kw belted generators | | | 6,200 |
| One 400-kw direct connected generator | | | 7,625 |
| One 600-kw engine driven generator | | | 9,700 |
| One 1000-kw generator direct driven | | | 10,500 |
| *Portable Instruments.* | | | |
| Two chronographs | | | $50 |
| Multiplier for wattmeter | | | 15 |
| Polyphase wattmeter | | | 86 |
| Portable voltmeter | | | 83 |
| Test meter | | | 7 |
| Frequency indicator | | | 45 |
| Portable wattmeter and voltmeter | | | 74 |
| Testing transformer | | | 40 |
| Wright demand indicator | | | 66 |
| Hydrometer | | | 4 |

During about 8⅓ years covered by the figures, hundreds of small extensions were made upon the overhead system over the entire city. In this period the company took down 30,000 ft. of direct-current lines, and 30,000 ft. of 500-volt, direct-current power lines, and erected in their place single-phase, alternating-current lines and two-phase, 220-volt, alternating-current power lines. The cost of the increases in the distribution system is given in the tables herewith.

OVERHEAD SYSTEM INCREASE COST, SALEM.

| | |
|---|---|
| 406 poles, average 35 ft. @ $9.00 | $3,654.00 |
| 52,240 ft. (5805 lb.) No. 6 wire series lighting @ 13 cts. lb. | 754.65 |
| 32,908 ft. (5485 lb.) No. 4 alternating mains | 713.05 |
| 128,640 ft. (32,160 lb.) No. 2 alternating secondary @ 13 cts. | 4,180.80 |
| 74,040 ft. (12,340 lb.) No. 4 wire, three phase secondary @ 13 cts. | 1,604.20 |
| 188,342 ft. (75,336 lb.) No. 0 wire, three phase primary @ 13 cts. | 9,793.68 |
| 23,716 ft. (2635 lb.) No. 6 wire @ 10 cts. | 263.50 |
| 21,816 glass insulators @ 5 cts. | 1,090.80 |
| 7,270 pole steps @ 3 cts. | 218.10 |
| 138 goosenecks @ 50 cts. | 69.00 |
| 46 single pole lightning arresters | 207.00 |

COST OF TRANSFORMERS.

| Number | Watts | Cost, Each | Volts | Number | Watts | Cost, Each | Volts |
|---|---|---|---|---|---|---|---|
| 7 | 1,500 | $27.79 | 104-208 | 14 | 20,000 | $162.88 | 104-208 |
| 12 | 2,500 | 36.34 | " | 8 | 25,000 | 191.95 | " |
| 30 | 3,000 | 40.61 | " | 20 | 30,000 | 222.57 | " |
| 8 | 4,000 | 48.74 | " | 3 | 75,000 | 384.00 | " |
| 26 | 5,000 | 56.86 | " | 4 | 5,000 | 63.00 | 2080–550 |
| 13 | 7,500 | 76.95 | " | 7 | 7,500 | 83.25 | " |
| 35 | 10,000 | 94.91 | " | 3 | 15,000 | 146.25 | " |
| 18 | 15,000 | 130.82 | " | 6 | 50,000 | 355.50 | " |

| | |
|---|---|
| 856 single pole primary switches @ 67¼ cts. each | $575.66 |
| 856 hangers @ 24 cts. each | 205.44 |
| Freight and express on above | 139.44 |

## GASOLINE LIGHTING AND THE UNDERWRITERS.

BY W. J. CANADA.

A total disregard of the fire hazard attendant upon certain types of gasoline lighting systems has recently been very generally imputed to insurance companies by central-station representatives throughout the country. Statements have frequently appeared in the technical press that no recognition of this increased fire hazard is made by fire underwriters either by making rigid inspection of installations to eliminate the more hazardous features or by the application of proportionately increased insurance charges where additional hazard exists due to these systems.

The rigid inspection of electric wiring is being contrasted with this alleged neglect of the gasoline lighting hazard, and the impartiality of underwriters is being questioned. The more thoroughly gasoline lighting is understood the greater will be the degree of safety demanded by the public, and to this degree the present accusations and attendant agitation may be ultimately of value. In this constantly better safeguarding of gasoline lighting, however, the underwriters will be found to have done most of the pioneer work.

In this connection it should be understood that gasoline for lighting purposes owes its development to the demand of small towns and isolated residences which cannot procure service from gas or electric companies. There has also developed a more limited demand in cities and towns where either or both electric light and gas service is available. This sometimes arises from the cheapness of the gasoline lighting or its apparent cheapness because of the lack of monthly bills; but the largest demand comes from persons who for one reason or another have become disgruntled with the lighting companies. Occasionally the service has been unsatisfactory, but more often the management of the lighting company has been unable to convince some particularly stubborn exponent of the existing prejudice against corporations of any kind, and the former customer becomes a blind advocate of any competitive form of light furnished at least apparently by a source within his own control.

In cities limited space has necessitated the adoption of more hazardous arrangement than that first developed, and flame-heated generators for the rapid generation of gasoline gas from small quantities of gasoline have come into use. In an attempt to limit this evident fire hazard, but one of unknown proportions, a system of examination was established for such systems by the Underwriters' Laboratories, and a qualified approval given to systems which, as far as possible, avoided the fire hazard attendant upon handling of explosive fluid. The general public distrust of gasoline and the numerous instances of injuries and fires reported daily in the press have united to restrict the use of gasoline for lighting very considerably. The restriction, as is to be expected, has been more notable in more settled communities than in new and rapidly growing towns.

Unfortunately, very few cities have yet established any censorship over the fire hazard of gasoline lighting systems. Like most other new fire hazards the amount of this one can be even approximately determined only by experience in fire losses. The municipality learns of these losses very rarely, except through underwriters' records; but the insurance charges have varied throughout the country for several years, owing to the fact that one community would have a considerable fire loss from defective gasoline installations, while another territory would be practically without such loss, although possibly with gasoline fires from other causes. Time was necessary to establish a fair measure of this fire hazard, in the face of such a sparse distribution.

To-day, however, a reasonably fair measure of the gasoline lighting fire hazard has been established generally throughout most sections of the country, and at the same time inspection is becoming more rigid as the particular points of fire hazard are becoming better understood and better evidenced by actual fire losses. This process of listing the points of fire hazard in gasoline lighting systems by obtaining actual evidence on fire losses caused by them has necessarily been slow—the more so as the total number of installations has been comparatively small.

During this same period electric wiring—originally in the same chaotic condition of unknown hazard and unregulated installation—has been approaching a condition of permanency in installation and almost perfect safety in operation. The immensely greater number of electric lighting installations, even from the early days of electric lighting, have made the compilation of fire losses from its defects comparatively easy; but, nevertheless, it has taken many years to bring about present standards of wiring at increased cost in the face of the eternal demand for "cheapness at any price."

With this history in view, the progress toward the standardization of gasoline lighting and the elimination of its hazards has perhaps not been so much delayed. The underwriters, in other words, realize that gasoline is a dangerous fluid to handle. The amount of storage in buildings has been limited to constantly smaller amounts, and in connection with lighting systems the elimination of liquid gasoline from the interior of buildings has been regarded for some time as tending toward the least fire hazard.

The uniform recognition of this fire hazard in insurance rates and the presentation of this hazard to building owners, city authorities, commercial bodies and the like are rapidly bringing about a public demand for the elimination of liquid gasoline in connection with gasoline lighting systems. This demand is purely from a standpoint of fire hazard, as must naturally be the case, and not from any desire for fair play for lighting companies. The latter, to be sure, have had the distribution of their product restricted by an increased cost of installation, with the purpose of securing safety; but fair play is rarely imputed to corporations or granted to them. In other words, however equitable may be the contention of electric-lighting companies and gas-lighting companies that gasoline lighting competition should be permitted only on a basis of equal safety, this feature has not been a determining factor and cannot become a determining factor in the municipal restriction of gasoline lighting system to its safest possible forms of construction. The ultimate exclusion of liquid gasoline from buildings is to be expected purely on the grounds of the public's recognition of its bearing on the national fire waste and the community's share in taxation for it. This recognition will result principally from statistics and recommendations of underwriters, since there is no federal bureau to supervise such matters or to promulgate regulations for public safety.

## EXTENSIONS IN DES MOINES.

### Central Station Improvements Under Way in the Capital City of Iowa.

Extensive improvements and additions are under way for the Des Moines Electric Company, of Des Moines, Iowa. A large addition to the company's steam generating station on the Des Moines River is nearly finished, the work on it having been carried on without interfering seriously with the operation of the existing plant. Fig. 1 is a general-arrangement plan of the station, with the new extensions, the old reciprocating engines and old boilers being indicated merely, while the new machinery is shown in detail. Fig. 2 is a cross-section through the new portion of the plant.

In the boiler room two new Stirling boilers having 4000 sq. ft. of heating surface each have been installed, and in addition two other Stirling boilers of equal size have been remodeled with the addition of superheaters to conform to the new boilers. A new steel stack, brick-lined, 15 ft. 6 in. in inside diameter and extending 200 ft. above the boiler-room floor has been built. Spanning the boiler room is an overhead electric traveling crane built by the Sprague Electric Company and equipped to operate a bucket having 1⅝ cu. yd. capacity. This crane is used in the coal and ash-handling operations. A series of coal pits is provided in the coal-storage space in

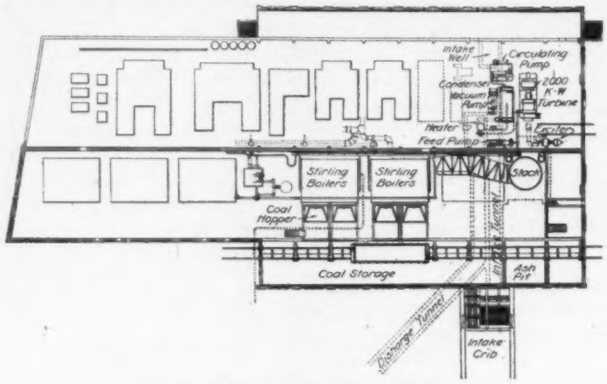



Fig. 1—Plan of Des Moines Station.

the boiler room, and by means of the overhead crane and bucket coal can be taken out of any of these pits, or from coal cars running on a track in the boiler room, and transferred to 10-ton hoppers in front of the boilers.

The boiler furnaces are equipped with chain grates, and the ashes are removed from the ash pits beneath the furnaces by means of small dump cars into the ash pit at the far end of the building, indicated in Fig. 2. From this ash pit the ashes are transferred by means of the crane and bucket to cars on the railroad track.

In the engine room the new equipment consists of a 2000-kw horizontal Curtis four-stage turbo-generator, with accompanying auxiliaries. The electrical end of this unit consists of a General Electric 3-phase, 60-cycle, 4-pole alternator designed to be operated at 1800 r.p.m. and wound for 2300 volts. A steam pressure of 150 lb. is used in the turbine. The steam auxiliaries of this unit are clustered about it or beneath it. These consist of a 6000-sq. ft. Worthington surface condenser; a 14-in. centrifugal circulating pump, engine-driven; a 10-in. x

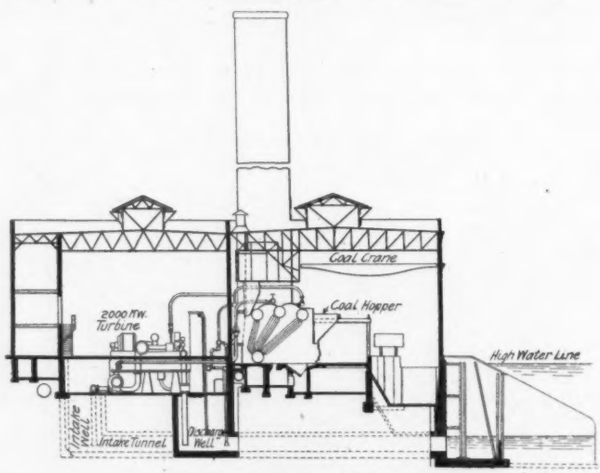



Fig. 2—Cross-Section of New Plant.

19-in. x 12-in. dry-vacuum pump; a vertical hot-well pump having dimensions of 6 in. x 8½ in. x 6 in.; a vertical feed-water heater having an area of 1600 sq. ft., and a duplex boiler-feed pump, made by the Warren Steam Pump Company, and having dimensions of 14 in. x 9 in. x 18 in. Electrical excitation is furnished by a 100-kw Westinghouse turbine-driven exciter. Space is left for a future 3500-kw turbo-generator, with its accompanying condenser and other auxiliaries.

The new portions of the boiler room and engine room of the power station are considerably higher than the older portions, but the walls were extended and the new roof put on before the old roof was dismantled, giving the impression that the new building was built over the old one. After the future 3500-kw unit is installed the old reciprocating engines will be gradually replaced by steam turbines, the work of remodeling the station proceeding from the north end of the building, at the right of Fig. 1, and working toward the south.

The station is built on the bank of the Des Moines River, and at the expense of considerable effort a new intake was built for condensing water. The intake tunnel leads to an intake well, from which suction is taken for the circulating pump of the present turbo-generator unit and which will also serve the additional units which may be installed later. The distance from the high-water line in the river to the bottom of the intake tunnel is 28 ft. and it may be remarked that the extreme high-water line in the river also marks the level of the boiler and turbine-room floors. A discharge well and discharge tunnel are provided, the latter being on the same elevation as the intake tunnel.

In the turbine room, but not shown in the drawings, is a 30-ton electric overhead traveling crane built by the Northern Engineering Works.

In the new station the switching operations are conducted on the remote-control principle, the switching galleries or chambers being shown at the left of the building in Fig. 2. The operating gallery is about 10 ft. above the turbine-room floor and is the middle one of the three switching chambers which may be discerned in Fig. 2. Here there is a black slate switchboard of 22 panels. All switches are electrically controlled.

In the upper electrical gallery are the oil switches, which are all solenoid-operated and of the type K of the General Electric Company. Here also are the disconnecting switches and the main buses mounted on pipe framework. All outgoing lines are overhead with the exception of the series-arc circuits and one three-phase feeder circuit. The voltage of transmission is 2300 volts, except in the case of the underground feeder, which transmits electrical energy at 13,200 volts, step-up transformers being placed on the turbine-room floor of the generating station. There is one three-phase series-arc circuit, three three-phase, three-wire circuits for 2300 volts, one three-phase, three-wire feeder circuit for 13,200 volts, and three single-phase feeder circuits for lighting load exclusively.

Underneath the switchboard in the electrical gallery on the level with the turbine-room floor are placed the excitation buses and the electrically operated field switches and rheostats for the generators and the alternating-current motors, which are in use in the older parts of the station. These motors, by the way, drive three-wire direct-current generating sets.

In addition to the power-station extensions the Des Moines Electric Company is making a number of other improvements. It is spending about $70,000 in enlarging its Edison three-wire underground district and is also building a substation on the margin of the underground Edison network farthest from the power station. The new substation building will be large enough for three 1000-kw motor-generator sets, and one of these is now being placed in position. Electricity is transmitted to the substation from the high-potential alternating-current underground feeder and is distributed from it to the 220-volt direct-current circuits of the Edison network, a balancing set being installed to take care of the 110-volt sides. The substation building has two upper floors for storage and shop space. It, together with the land, cost about $50,000.

The Des Moines Electric Company is the successor to the Des Moines Edison Light Company, and it is a progressive and enterprising concern. Mr. W. B. McKinley, of Champaign, Ill., is president of the company, and Mr. P. B. Sawyer, of Des Moines, is general manager. Sargent & Lundy, of Chicago, were the engineers who designed the additions to the power station.

# Wiring and Illumination

## LOW COST LIGHTING IN CUMBERLAND, MD.

According to the report of the Maryland Water and Electric Light Commissioners Cumberland is the best lighted city in the country, besides enjoying the distinction of paying the least for energy per lamp. The city is lighted by 317 arc lamps of 1200 cp each at a cost of $33.46 per lamp per year. Natural gas is used under the steam boilers at the generating station, which is controlled by the municipality. Prior to municipal ownership of the plant the city paid a private company $97 per lamp per year.

## LIGHTING EFFECTS IN A MODERN HOTEL.

### Artistic Illumination and Fixtures of the New Blackstone, Chicago.

Thoroughly in keeping with the beautiful design and fittings of the new Blackstone Hotel of Chicago, pronounced to be the most ornamental hotel structure in America, is the tasteful and efficient illumination scheme which combines some of the most artistic creations of the fixture designer with approved principles of light distribution.

A preliminary description of this fine 20-story hotel, at Michigan Avenue and Hubbard Place, was given in the *Electrical World* of November 4, 1909, and included a detailed account of the various complete electrical and mechanical features of the equipment. The plans for this apparatus, as formulated at that time and described in the article mentioned, have been carried out with very minor changes, so that only a brief recapitulation of some of the figures previously printed is given near the end of the present account. The accompanying description and views of the completed hotel will be interesting, however, rather in setting forth these visible evidences of electrical applications in both decoration and lighting, which impress the lay visitor or guest, who is probably unconscious of the elaborate equipment concealed beneath the handsomely appointed apartments.

#### GENERAL ARRANGEMENT AND EXTERIOR LIGHTING.

As finally completed, the lighting of the Blackstone Hotel employs over 9000 incandescent lamps. Wherever possible, high-efficiency units have been used, in order to attain the minimumof energy consumption consistent with good illumination. A 700-kw direct-current generating plant in the basement supplies electricity for lighting the hotel. Since the final plans were drawn it has been learned that this plant may be called upon to furnish the lighting for a new theater which stockholders of the hotel company are building on the adjoining plot on Hubbard Court. With this later demand now highly probable, the engineers have been able, by revising their lamp schedule and lamping the original installation with high-efficiency units wherever feasible, to leave a considerable block of energy for the theater load. This example serves to illustrate pointedly one of the important results of the introduction of the tungsten lamp, enabling the designing engineer, even after his carefully laid plans have been put awry by some later contingency that could not possibly have been foreseen, to recover the situation and make his former complement of generating equipment perform successfully the increased lighting duty. The hotel proper now contains about 4000 tungsten lamps, 2000 tantalums, and more than 3000 carbon-filament incandescent lamps, the large proportion of the last-named being of the small candelabra-base type used on brackets throughout the guest rooms and corridors. Tantalums have been employed for all portables and other lamps which are subject to possible handling.

The exterior lighting of the Blackstone Hotel building makes it one of the city's landmarks at night. Along the line

of the French mansard roof, 287 ft. above Michigan Avenue, is ranged a row of 30 standards, each carrying an opal ball containing a 60-watt tungsten lamp. The third-floor level carries a line of 36 similar pillars, marking the architectural design at that point. For the sidewalk illumination at the street level there are four flaming-arc lamps housed in massive bronze lanterns hung from brackets of rich design. The principal entrance is on the Hubbard Court side under a porte-cochere lighted by four 12-lamp clusters, and ornamented with 84 25-watt tantalum lamps marking the plate-glass leaves of the canopy. A three-figure electric carriage call completes the lamp equipment of this entry.

Fig. 1—Lobby Lighted by Shaded 25-Watt Tungsten Lamps.

### USE OF DIRECT AND INDIRECT LIGHTING.

The interior decoration of the hotel has been laid out on the same lavish yet refined scale, after the period of Louis XVI, which characterizes the external architecture. The lighting fixtures are thoroughly in keeping with the elegant quality of the decorations and furnishings. In the lobby, corridors, ballroom, main dining room, and guest rooms, visible light sources have been employed, in appropriate fixtures. The bracket lamps in the lobby and corridors are heavily shaded by rich canopies. For the west dining room, kitchens, buffet, barber shop and business offices the indirect system of illumination by concealed tungsten units with reflectors lends itself gracefully to the scheme of decoration.

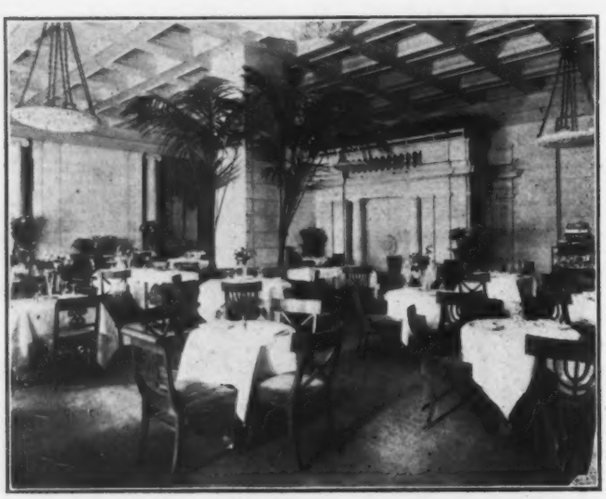


Fig. 2—Indirect Illumination of West Dining Room.

The lobby is lighted by 25-watt frosted ball tungsten lamps, enclosed in Louis XVI. shaded ceiling fixtures and in brackets mounted on the circassian-walnut pillars and wall facings. This room is approximately 75 ft. square, and contains 375 of these 25-watt tungstens. Directly behind the lobby is the so-called Marble Room or west dining room. This handsome room, 48 x 50 ft., with a 16-ft. ceiling, is lighted by the indirect system from six large bowls of classic design suspended by bronze chains from the ceiling. Each bowl contains 20 40-watt tungsten lamps and reflectors, projecting all light first onto the white paneled ceiling, from which it is reflected down into the room.

### CANDELABRA IN MAIN DINING ROOM.

Up half a dozen steps at the east end of the lobby, and overlooking Lake Michigan, is the main dining room, 75 x 60 ft. This is an especially ornate hall, its decorations being inspired, like the ballroom, which is of the same dimensions and directly above, by the Little Trianon palace at Versailles. In keeping with the spirit of the age reflected by the decorations, candle effects have been used throughout in the illumination of these two grand salons. From the ceiling of each are suspended five huge crystal chandeliers, the central one carrying 40 electric "candles" and the other four 20 candles each. The counterfeit candles are tipped with special 16-cp carbon lamps whose coiled filaments enclosed in relatively large spherical globes give a flame effect that is particularly effective when viewed across the room. In the ballroom 100 brackets on the side walls each contain three similar candle units. For the dining room there are 18 six-lamp side-wall brackets, besides the large ceiling fixtures. Each table is individually lighted by a candlestick cluster of three 6-cp carbon lamps. Those around the edge of the room are 110-volt lamps energized through attachment cords from the baseboard outlets of the hotel wiring system. The electric candles on the central tables are 6-volt lamps fed from individual storage batteries mounted under each table.

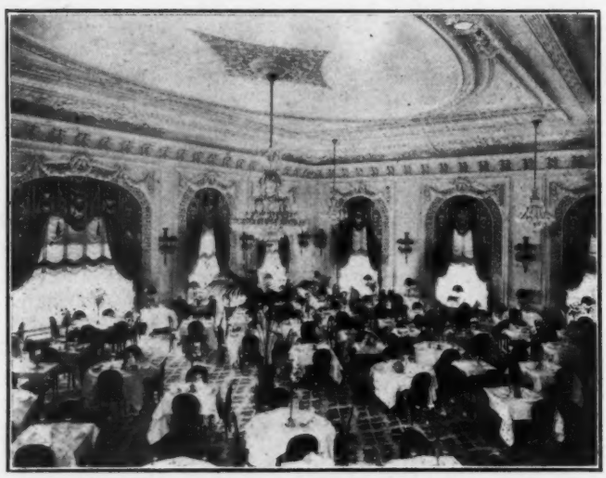


Fig. 3—Main Dining Room.

An electric "arctic fountain" of artificially frozen ice is to be a feature of the main dining hall, cooling the room in summer, and refreshing the atmosphere at all times of the year. The design has not yet been completed, although several suggestions have had the attention of the architects, and the wiring and refrigerating brine pipes are already in place. One design contemplates a huge sphere of ice on which colored lights will be flashed from within. Another proposes an artificial iceberg with an ever-varying auroral display, and even more elaborate suggestions have been made.

### VARIOUS TYPES OF FIXTURES.

The several private dining rooms, finished in French, Colonial and English decorations, are appropriately lighted by fixtures conforming to the periods denoted by the furnishing.

The kitchens have a floor to themselves one flight above the main lobby and the Marble Room, and halfway between the main dining room and the banquet hall or ballroom. The lighting of the kitchen quarters is carried out by 70 two-arm

indirect units, each containing two 60-watt tungsten lamps hung with their reflectors 18 in. from the ceiling. The walls and ceiling throughout are finished in white, and lined with blue pencilings which give a tile effect. Cooking is done with gas and steam, although an electric grill is installed in the buffet on a floor below. The kitchen is used for cooking and food-preparing operations alone, no dish-washing or other allied work being done in these quarters. The electrically driven equipment of this department includes a soup-strainer, meat chopper, potato-parer, ice cream freezers, dish-washing machine, silver cleaner, knife polisher, and numerous dumb-waiters and conveyors.

The art hall, on a floor above the lobby level, is a 24-ft. corridor, 100 ft. in length, in which will be hung a number of fine paintings purchased abroad. It is lighted by six central ceiling domes, with loops of cut-glass beads, each lamp cluster comprising 10 25-watt clear round-globe tungsten lamps.

### MEN'S LOUNGE AND AN ORNATE BARBER SHOP.

Below the main dining room is a passage to the Michigan Avenue entrance at the street level. Open lamps on torchère brackets surmounted by the French crown, and an illuminated marble fountain, are the principal decorative features of this entry-way, which communicates with shops on the street level.

Another half-flight below is the men's 'club" or lounging room, and at the rear is the buffet with its bar and grill. In these rooms indirect lighting is again used, the ceiling of conventionalized relief pattern being lighted by 109 40-watt clear

Fig. 4—Indirect Lighting of Buffet, Showing Electric Grill.

tungsten lamps which are mounted on stalactites and project into the bowls of silver-plated reflectors of special design. The ceiling is gray-white in color, and is broken up into deep panels. With the dark furniture and fittings of the Elizabethan period provided in this room it was a question whether indirect illumination might be satisfactorily used for lighting under these conditions. The resulting effect, however, is very pleasing, and the illumination afforded is ample. The room is 68 x 44 ft., with an 11-ft. ceiling. The grill at the west end of the buffet is equipped with three electric broiler elements where the finest cuts of meat are cooked to a turn without contact with smoke or gas fumes.

The Blackstone barber shop, which is entered from the men's lounging room, is generally pronounced one of the handsomest and best equipped rooms of its kind in the world. The general scheme is the Greek classic, the mirrored walls being framed by white marble columns, while overhead is a pale-blue domed ceiling bordered by a latticed pattern carrying out the effect of an outdoor pergola. All of the equipment and trimming, except the red-plush upholstering, is of sanitary white, adapting this room well for indirect illumination. The lighting is done from six large bowls of chiseled alabaster design, hung four feet from the ceiling and each containing five 60-watt tungsten lamps and their inverted reflectors. The indirect illumination of this shop enables the barbers to work without attention to shadows, as the general diffused nature of the lighting, aided by the large number of mirrors, makes the illumination practically uniform from any direction at any chair.

### LIGHT FEATURES OF GUESTS' ROOMS.

All guests rooms are above the third floor. Decorations and even the furniture in these quarters partake of the French

Fig. 5—Kitchen, Indirect Lighting from 60-Watt Tungsten Lamps.

period denoted by the architectural surroundings. The lighting equipment provided these rooms is probably the most complete of any hotel yet built. The central drop fixtures are of simple, dignified design carrying three and four 25-watt bowl-frosted tungsten lamps, from which the light is utilized directly. Portable reading lamps (25-watt tantalums) are placed on central tables, and special 25-watt sominoles or night lamps are provided in all bedrooms. One and two-lamp bracket wall fixtures are installed in bedrooms and boudoirs, and 16-cp clear-globe carbon dresser lamps are mounted on each side-column supporting the mirrors of the chiffoniers, special attention having been paid to locating these for the practical convenience of the guests.

Another evidence of this care is the arrangement of the

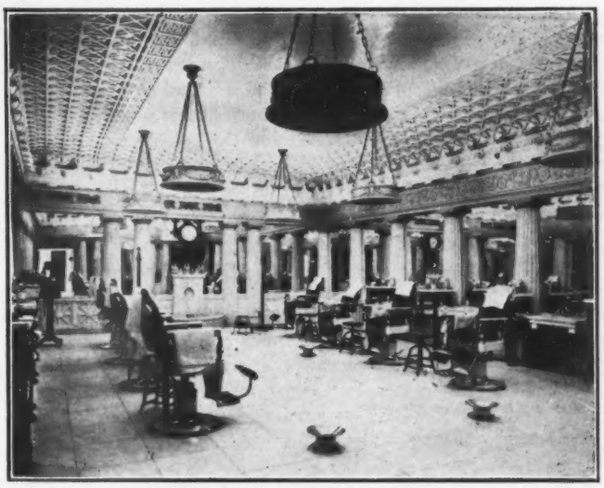


Fig. 6—Barber Shop, Showing Bowl Reflectors.

shaving lamps, for example, on the mirrors over the wash bowls in the private bathrooms. The receptacles of these 16-cup frosted bunghole lamps are fitted with flexible cord from outlets in the framing, and are themselves mounted on clamp carriages which slide on vertical bars 24 in. in length, so that they may be easily adjusted by the guest to the desired height.

Provision is also made for attaching electric curling irons which, like electric fans, are furnished guests on request. The rooms are completely wired with baseboard outlets for attaching reading lamps and fans.

By means of a special switch, the lights in any guest room are automatically extinguished when the door is locked from the outside. The application of the magnet switches by which this result is accomplished is a distinct novelty in hotel wiring. All of the various flush push-switches in each suite are wired under one master-switch mounted in the same flush switch group. This master switch, which must be "on" in order to get light from any of the outlets, is equipped with a magnet

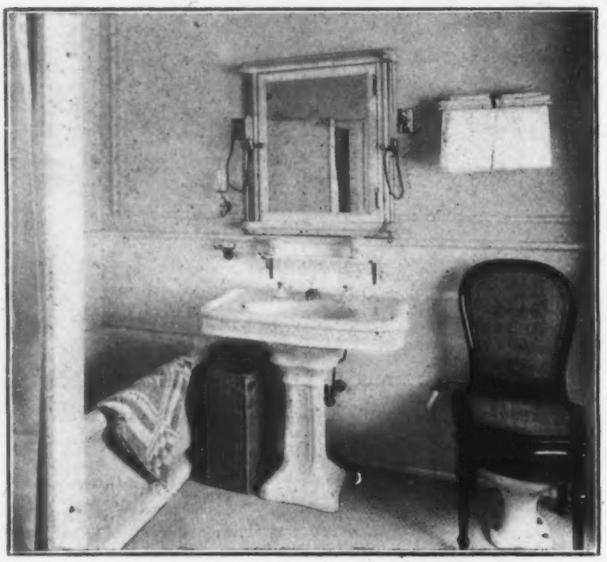


Fig. 7—Private Bath Room Showing Adjustable Side Lamps.

coil, whose armature is arranged when energized to snap the switch into the "off" position. The magnet coil is adapted to be momentarily energized across the 110-volt circuit, through a wiping contact made by a sleeve which is lifted as the bolt is shot in the door, when the key is used from the outside. Thus as the key is turned, the magnet is energized, snapping "off" the master switch, which extinguishes all the lights.

OTHER APPLICATIONS OF ELECTRICITY.

Communication between the various rooms and stations of the hotel, is secured by a complete private branch exchange system of 450 telephones, and for the transmission of orders an elaborate telautograph system of 28 transmitting and 32 recording instruments is in use. There is also an electrically synchronized time-stamp system, with 28 stamps installed, and a pneumatic impulse system for synchronizing the clocks throughout the hotel.

The building is equipped with 72 motors ranging from ¼ to 40-hp, and aggregating 500 hp.

The power plant on the basement level, three stories below the sidewalk, contains two 200-kw and one 300-kw direct-current engine-driven generators, and four 250-hp boilers with automatic stokers. The basement also contains ice-making and air-cooling machinery, aggregating 170 tons refrigeration daily. The hotel water supply is divided into two services for the upper and lower stories respectively, and is delivered from pumps in the basement plant.

The electric wiring of the Blackstone installation was done by the Arthur Frantzen Company, the fixtures were furnished by T. W. Wilmarth & Company, and the indirect-lighting units were supplied by the Curtis-Leger Fixture Company, all of Chicago.

The Blackstone is owned and operated by the Drake Hotel Company, of which Mr. Tracy C. Drake is president and Mr. John B. Drake is vice-president. Mr. F. K. Boomhower is chief engineer.

# Letters to the Editor.

## A Peculiar Underwriters' Ruling.

*To the Editor of Electrical World:*

Sir:—The author of the article entitled "A Peculiar Underwriters' Ruling," which appeared in the July 7 number, does not seem to have referred to the April, 1910, *List of Approved Fittings.* On page 23 of that issue is published a list of cut-out bases for fuses rated 31-60 amp, 250 volts, and designed to take encased cartridge fuses. On page 29 of the same issue is also a list of plug-fuses rated at 31-60 amp, 250 volts.

Mr. Kemery's objections to the open-type cartridge fuse are only too well founded and, as will be found in most cases, the Underwriters have endeavored to meet the difficulty. He has, however, no ground for complaint here, and by writing to the nearest inspection office can obtain not only a quicker solution for his trouble, but a higher opinion and better feeling for the Underwriters as well.

The construction rules were purposely omitted from the 1910 edition of the *National Electrical Code,* partly to induce the contractor to refer to the *List of Approved Fittings* rather than to the rules, to determine whether or not a device is standard. The label reading "N. E. Code Std." should satisfy the most particular, and will be found on encased cartridge fuses rated at 31-60 amp, 250 volts.

*Topeka, Kan.* Howard Campbell,
*Kansas Fire Insurance Inspection Office.*

*To the Editor of Electrical World:*

Sir:—I have read with interest the article by Mr. G. S. Kemery in the July 7 issue, entitled "A Peculiar Underwriters' Ruling." It may be well to point out that 250-volt, 0-30-amp National Electrical Code Standard fuses in plug casings have been limited to 125 volts, for the reason that two-wire plug cut-out blocks have been very largely used for the protection of motors on 250-volt circuits. These blocks were passed upon inspection when they had 250-volt fuses in National Electrical Code Standard plug casings, but upon the blowing of the original equipment, it was found that there was a great tendency to replace the code fuses with Edison fuse plugs, such as shown in Fig. 9 of the article. It was in order to prevent this misuse of Edison plug fuses that the perfectly reliable plug casing, with its National Electrical Code Standard fuse, had to suffer.

I think the writer of the article is mistaken in his assumption that 31-60-amp fuses in plug casings are not approved for 250 volts. In fact, they are so approved and the company with which the writer is connected manufactures them in large quantities. I am glad the article was written, because I think it will bring to the attention of the Underwriters the injustice they have done the manufacturers and users of Edison plug casings.

I agree with many of the arguments advanced, but I cannot see how anyone can receive a shock when pulling out an 0-30-amp or a 31-60-amp, 250-volt fuse, for if the installation is made in accordance with the rules, the current can be cut off by a switch before a removal or replacement is made.

*Hartford, Conn.* Robert Chas. Cole,
*Electrical Engineer, The Johns-Pratt Company.*

*To the Editor of Electrical World:*

Sir:—Some operating men will undoubtedly consider that the reason given in the first paragraph of Mr. Cole's letter is a very good one for withholding approval on 0-30-amp fuses in fuse-plug casings for pressures between 125 volts and 250 volts. It has been suggested that, although the Edison plug-fuse (now approved for 125 volts), which was in its time an excellent device and has given good service, may have its applications, the combination of the fuse-plug casing and a

National Electrical Code fuse is much the better equipment. Many appear to believe that it would be better to withhold approval altogether of the Edison plug-fuse than to permit it to interfere with the installation of the casing-fuse combination, which is a better arrangement, both electrically and mechanically.

Referring to the second paragraph of the letter, if the use of 31-60-amp fuses in fuse-plug casings is approved, it should be so stated definitely in the rules. There are many, including certain inspection departments, who do not seem to understand this point.

Referring to the third paragraph, as we understand it, a cut-out may be placed on either the line or service side of a switch, except at entrances, and thus there are many installations in which it is not feasible to render a cut-out "dead" by throwing a switch. Often in motor installations a cut-out (without a switch) is placed where the conductors to a motor are tapped from a main. The switch is placed near the motor, often on its central panel. Obviously in this case—and there are many such—there is no means for cutting voltage from the cut-out.

*Pittsburgh, Pa.* G. S. KEMERY.

# Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

## Generators, Motors and Transformers.

*Compounding of Alternators.*—A. BLONDEL.—The author refers to a recent article by Dalemont and Herdt who compound an alternator by compensating for only that reaction due to the wattless component of the current. The problem is to create in the field winding, under load, additional ampere-turns proportional to the wattless component of the current. The present author realized this object as early as 1896 in his reaction exciter, the principle of which is described as follows: "The method consists in the use of an exciter of the Rechniewski type, with a small air-gap; the field windings, constructed in the usual manner, are shunt-connected and excited just enough to produce the excitation required by the alternator on open circuit; the armature, which rotates in synchronism with the alternator by a mechanical coupling, has two windings, the one winding carrying continuous current for exciting the alternator and the other carrying current from the alternator and acting as a compensating winding similar to the alternator winding; the number of turns, and the points at which the current is led into this winding are so adjusted that the reaction field produced by a wattless current has the same direction as that of the main field, and strengthens it in exactly the same proportion that the corresponding armature reaction of

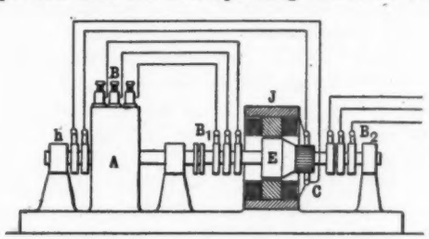



Fig. 1—Compounding Alternators.

the alternator tends to weaken its own field; in addition, the brushes are kept fixed by one of the known methods. Under these conditions, if the alternator and the exciter are both being worked below the knee of their saturation curves it is easy to see that all of the armature reactions, watt or wattless, are compensated automatically. Fig. 1 represents this arrangement for a three-phase machine with rotating field cores. *A* is the alternator, *B* the terminals from which the currents are led to $B_1$, the slip rings connected to the compensating winding on the exciter *E*, $B_2$ the main terminals, *C* the commutator of the main exciter winding and *J* the shunt winding. Of course, the alternating current can be passed directly through the armature exciter only when the tension is low. With high-tension alternators a series transformer must be inserted. Fig. 2 represents the scheme of compounding as it is actually applied. In addition to the apparatus already described, there is a small direct-coupled dynamo for a new and important purpose. This machine supplies a part of the excitation for the exciter *E*, and thus ensures the stability of the magnetic equilibrium of the system at all loads. It is a very small machine and always works on the same load. On the other hand, the exciter *E* and the transformer do not work at constant and complete saturation of the iron. Fig. 3 shows the diagram of connections of the exciter *E* for a bipolar machine. In reality, it is evidently convenient for this exciter to have the same number of poles as the alternator or else it must be driven by a multi-

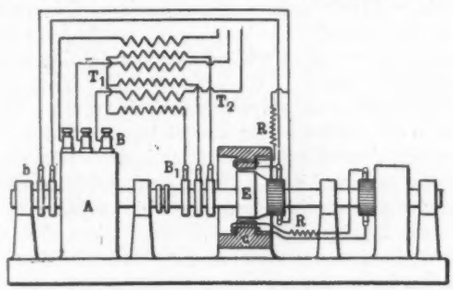



Fig. 2—Compounding Alternators.

plying gear. With turbo-alternators the number of poles is, however, almost always either two or four." The author gives the mathematical theory of compounding by means of this reaction exciter and then discusses the methods of voltage regulation by means of the rheostats *R* and *R'*. By regulating the rheostat *R* in the shunt circuit the total value of the alternator exciting current can be adjusted in a certain proportion, but the relative value of the compounding effect is unaltered. By regulating *R'*, and hence the excitation provided by the small auxiliary exciter, the relative value of the compounding is adjusted. It is, therefore, very simple to modify at will the compounding effect as well as absolute voltage of the alternators. Examples of actual installations and test results are finally given.—Lond. *Electrician*, July 15.

*Mutual Induction.*—J. REZELMAN.—The conclusion of his

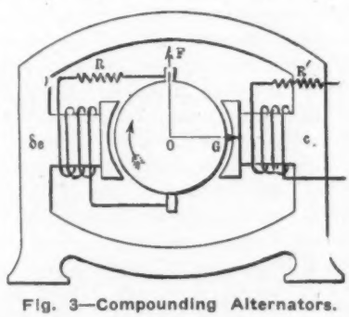



Fig. 3—Compounding Alternators.

mathematical article on the determination of the mutual induction between the external coils of the stator and the rotor of an induction motor.—*La Lumière Elec.*, July 9.

## Lamps and Lighting.

*Metallic-Filament Lamps.*—H. VON LOETI.—A paper read before the Vienna Electrical Society on the development of the

1-watt-per-candle-power metallic-filament lamp during the last two years. The author gives reasons for his belief that the metallic filament is at a lower temperature than the carbon filament when operating with the same specific consumption. He then describes in detail the rotary mercury pump of Gaede, which is specially suitable for producing the high vacuum required in metallic-filament lamps. He refers to the progress made in manufacturing high-voltage and low-candle-power metallic-filament lamps and to the reduction in price, which has been about 40 per cent in the last two years.—*Elek. und Masch.* (Vienna), July 10.

*Tubular Incandescent Lamps.*—A note on a recent British patent of C. O. Bastian (13,228, 1909; June 30, 1910). The tubular lamps described may be of considerable length, and have a terminal cap at each end. The filament is made up of several short lengths in series, connected together with springs. Each spring has its central convolutions of nearly the internal diameter of the tube, so that, although not attached to, it touches the glass. Support is then given to each section of the filament without sacrificing freedom for longitudinal movement.—Lond. *Elec. Eng'ing,* July 7.

*Different Methods of Lighting from the Standpoint of the Ophthalmologist.*—Gariel.—A paper read before the convention of the French Ophthalmological Society in which the author reaches the following conclusions. Mercury-vapor lamps are not suitable for lighting except in very particular cases. Electric arc lamps are suitable for lighting in open air and in halls or rooms of large dimensions. They should be placed at a distance of several meters from the point where the people are. These lamps should be enclosed in diffusive or prismatic globes of sufficient dimensions so that the surface brightness is not too high. In rooms of restricted dimensions arc lamps are suitable in connection with a system of indirect lighting which is very satisfactory. Electric incandescent lamps can be used in all cases; they are especially suitable for rooms with restricted dimensions. In school-rooms, studies, and in all work shops where delicate work is carried out, the minimum illumination should be 15 luxes. The use of special colored glasses in special cases is finally discussed.—*La Revue Elec.,* July 15.

*Public Lighting.*—J. Abady.—A paper read before the British Institute of Gas Engineers on public lighting from a municipal point of view. The author first considers the different forms of street-lighting contracts which are in vogue and discusses the relative merits of each form, reaching the conclusion that to buy street lighting on the illumination basis is the most advantageous course. He then passes to the question of the position of the lamps and the distribution of the light, emphasizing the fact that street lighting in many cases degenerates into a haphazard scheme of point lighting. He urges the desirability of decreasing the candle-power of light units and placing them closer together.—Lond. *Electrician,* July 8.

**Generation, Transmission and Distribution.**

*Electric Lifting Appliances.*—F. Heym.—An abstract of a paper read before the International Mining Congress at Düsseldorf on the influence of electricity on the development and efficiency of lifting apparatus in mining and steel works. The introduction of electricity as motive power has enabled the working speeds of cranes, etc., to be increased considerably and to extend the applicability of hoisting machines, owing to the convenient transmission and supply of the energy. The result has been an increase of the production and increased demands of the efficiency of the transporting appliances. By electrical driving it is possible to operate the different motions with precision and rapidity from any desired point. On account of the centralization of the generating plant thus made possible, the working expenses are reduced, and it is feasible to adopt mechanically-driven lifting appliances for dealing with work, where their application previously was not economical. Electric winders, circular wagon tips, wagon tipping devices, and loading bridges effect the transport of the material raised from the mines, almost dispensing with the attendance of workmen. Where it would not pay—owing to the small amount of work to be coped with—to adopt large loading bridges for the transport of bulk goods, telpher lines with single traveling trolleys are provided in their place. In blast furnaces the transport of the materials to the mouth of the furnace is almost exclusively carried out by means of inclined electrically driven hoists, which render no workmen necessary on the charging platform. The handling capacity of these hoists has already attained some 2200 tons of coke and ore in a shift of 18 hours. In steel works and rolling mills special types of cranes have been adopted for each sort of work. Special cranes serve for filling and transporting the boxes in open-hearth plants and for charging them into the furnace. The casting cars traveling on the floor are now almost entirely displaced by overhead casting cranes running at high speeds. For stripping the ingots from the molds and transporting them to the soaking pits and reheating furnaces, as well as for loading the half-finished and finished products, special cranes with tongs, lifting magnets, rotary and tilting grippers are now constructed. The use of lifting magnets, which obviate the necessity of sling chains or tongs, has been especially developed. By employing a lifting magnet in handling scrap and similar materials, the manual labor is almost dispensed with and consequently large savings are effected.—Supplement to Lond. *Elec. Eng'ing,* July 7.

*Electric Power in Mines.*—P. Nicou.—An abstract of a paper read before the International Mining Congress at Düsseldorf on the present situation of the mining industry in French Lorraine. Most of the new winding plants in the Briey mines are electric, and electric power, derived usually from turbine-driven stations, is employed on a large scale for underground pumping, haulage and drilling. Power drills, which are extensively used in the new mines at Briey, enable the mining of the ore to be carried on at a much quicker rate than was possible with hand drilling. Up to the present, electric drills are mainly used, though pneumatic percussion drills are employed in some cases.—Supplement to Lond. *Elec. Eng'ing,* July 7.

*Underground Haulage in Mines.*—F. Tillmann.—An abstract of a paper read before the International Mining Congress at Düsseldorf. The author said that continuous-current overhead trolley locomotives have proved their economy, and more lately single-phase and three-phase mining locomotives have come into use. Accumulator locomotives are not quite as economical, but render electrical haulage available where overhead wires are not provided. Locomotives are confined to horizontal galleries, but electrical rope haulage is used either on inclines or on the level, and is just as economical or, in favorable conditions, even more so.—Supplement to Lond. *Elec. Eng'ing,* July 7.

*Electric Plow.*—H. Wallen.—In a continuation of his recent illustrated article on the use of electric power in agriculture the author discusses in detail the advantages of the electric plow over the steam plow with respect to savings in wages and horses and gives data on the energy consumption.—*Elek. Zeit.,* July 14.

*Heat Transfer Due to Steam Condensation.*—S. L. Brown.—An account of an investigation which shows that the rate of delivery of heat by hot steam to a cold metal surface is at least 40 times as great as the rate of delivery of heat to the cold metal surface by hot air at the same temperature as the steam, and, therefore, assuming superheated steam to be approximately the same as air in its thermal conductivity, it is evident that the elimination of actual condensation on the cylinder walls of a steam engine greatly reduces the exchange of heat between the working fluid and the cylinder walls.—*Phys. Rev.,* July.

*Smoke Abatement.*—J. B. C. Kershaw.—An article discussing the work done on smoke abatement by two societies in London and Hamburg respectively. The London society draws its support chiefly from the artistic and cultured classes of London society. The Hamburg society is differently constituted and has more practical aims, since its object is to reduce smoke by educating the fuel user in more efficient methods of combustion.—Lond. *Elec. Rev.,* July 15.

### Traction.

*Three-Phase Traction on Railways.*—W. HEYDEN AND K. VON KANDO.—Two articles, the first of which, by W. Heyden, states that the Italian railways intend to equip electrically 10 different lines and that on all of them the three-phase system as used on the Valtellina road will be employed with 3000 volts at the trolley wire and a frequency of 15 cycles per second. He then gives a review of a recent paper by Kando on the advantages of the three-phase system for trunk-line traction and describes one of the new electric freight locomotives to be used on the Italian roads. He does not agree with the advantages claimed by Kando for the three-phase system, but thinks that according to present experience only single-phase current is suitable for traction on trunk railways. In the second article, K. von Kando replies to these criticisms. He says that in electrical and traction trade journals there are often made statements concerning the three-phase system which are based on purely theoretical considerations, but not on practical experience, and in which the constant speed is often mentioned as a disadvantage of the three-phase motor. He claims on the contrary that the constant speed has great advantages in practice, while, on the other hand, the high output of the three-phase motor per unit of weight renders the three-phase locomotives especially suitable for lines containing considerable grades.—*Elek. Zeit.*, July 14.

*Electric Traction in Austria.*—A. HRUSCHKA.—His report before the International Railway Congress in Berlin on the work done in Austria with respect to the electrification of the railways. Detailed studies are now being carried out by the Austrian Railway Department on roads having a total length of 1000 km (600 miles). In the first line, the road from Triest to Opcina and the Arlberg road are projected to be electrified. It is the intention to employ the single-phase system with 10,000 volts at the trolley wire, the frequency being 15 cycles per second.—*Elek. Kraft. u. Bahnen*, July 14.

*Electric Locomotives on Curves.*—K. WIESSINGER.—An article illustrated by diagrams giving calculations on the passing of electric locomotives over curves, with special reference to the effect due to the rotary masses of the locomotive. One of the recommendations made by the author is that in a curve the outer rail should not be raised by the whole amount theoretically necessary, but by only one-half this amount, and that the inner rail should be lowered by one-half the amount. In this case there will be no raising or lowering of the center of gravity of the locomotive while passing the curve.—*Elek. Kraft. u. Bahnen*, July 4.

*Interurban Line.*—J. R. HEWETT.—A detailed and fully illustrated description of the 1200-volt, direct-current interurban line of the Milwaukee Electric Railway & Light Company, parts of which were formerly operated by 3300-volt, single-phase current.—*Elec. Rail. Jour.*, July 16.

### Installations, Systems and Appliances.

*Earthing of Coal Cutters.*—J. B. ENGLISH.—An abstract of a paper read before the Warwickshire and South Staffordshire Section of the Association of Mining Electrical Engineers. He gave the results of his experiments on the earthing of coal cutters. He used the two-wire, 440-volt, direct-current system. The insulation resistance of the positive main was 110,000 ohms, and that of the negative 55,000 ohms. Between the positive and the machine frame the potential difference was 24 volts. With the positive terminal to frame 7.0 milliamperes passed to earth, and with the negative terminal to frame 4.7 milliamperes. When a special wire was run to earth from the frame, no difference was found in the results given above. A spike 12 in. into the ground afforded an earth of lower resistance than a plate. With the negative cable effectively connected to earth, and the positive joined directly to the frame of the machine, the current passing to earth was 5 amp; with the positive connected to the plate 0.05 amp passed, and with it connected to the spike 7 amp passed. When the positive cable was connected to the frame, the potential difference between the frame and a plate laid in the ground was 390 volts, and between the frame and a spike driven into the ground, 420 volts. He drew the inference that if the insulation of a direct-current system is good there is no need for earthing, but as it is impossible to ensure good insulation throughout a mine, it is advisable to earth both the portable and the stationary machines. As regards the method of earthing, armored cables are advocated by many, the armor being used as the earth wire. In his opinion armored cables are unwieldy and wanting in flexibility; the insulation is also liable to be pierced by the armor. He prefers providing a separate earth wire wormed up with the conductors, the whole being protected by a brading of leather or cord. He has found cord both durable and very flexible.—Supplement to Lond. *Elec. Eng'ing*, July 7.

*Buffer Batteries.*—K. ZICKLER.—An article describing an analytical and graphical method for predetermining the proper size and the action of a buffer battery operating in parallel with a generator. The article is illustrated by diagrams. The method is based on the knowledge obtained experimentally of the characteristic curves of the behavior of the storage battery and the machine and presupposes the knowledge of the amplitude and duration of the current rushes during which the battery has to act.—*Elek. und Masch.* (Vienna), July 10.

*Transformation of Electrical Energy Into Heat.*—A. PONZINI.—The author first discusses the disadvantages of transforming the electrical energy of high-tension currents directly into heat by means of the Joulean effect. He recommends the production of heat by means of Foucault currents in a magnetic material. He describes the construction of a magnetic core in which Foucault currents are produced in this way and its application to the heating of liquids. The application of the method for utilizing the surplus power of central stations for heating purposes is discussed.—*Atti della Assoc. Elettrotecnica Ital.*, March, April, 1910; *La Lumière Elec.*, July 9.

*Oil-Break Switches.*—F. DEHLER.—A translation in abstract with illustrations of his recent German article on the design of oil-break switches.—Lond. *Electrician*, July 15.

### Wires, Wiring and Conduits.

*Localization of Faults on Underground Mains.*—W. A. TOPPIN.—A paper read before the Glasgow Section of the (Brit.) Inst. Elec. Eng. After discussing the causes of faults, and the recording of earth leakages, the author describes a simple method of locating earth leakages and the apparatus he has constructed for facilitating the test. Its operation depends on the fact that when an earth leakage occurs, the earth in its vicinity is charged to a potential above normal earth potential, and this potential will vary at any point in inverse proportion to the distance from the fault. Assume an earth leakage at *E* on a 250-volt three-wire system of distributors (Fig. 4), the current shown on the ammeter with the 10-ohm limiting resistance in circuit being 10 amp through the fault. This result shows a total resistance between the fault and the earth plate of 15 ohms and a difference of potential of 150 volts. This pressure will be highest immediately at the fault and will diminish with the distance from the fault. It can be measured by an ordinary voltmeter, but in most cases a special voltmeter, calibrated to read down to very small pressures, is desirable.

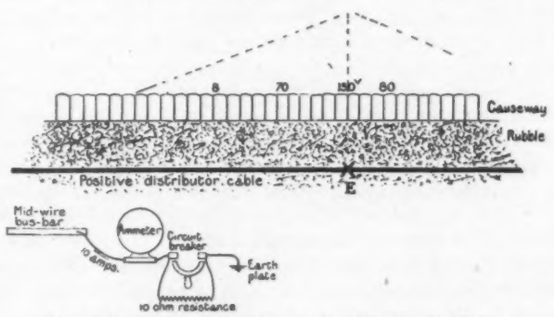



Fig. 4—Localizing Faults on Underground Mains.

One terminal of the voltmeter is connected to a rubbing contact and the other to a good earth connection, such as a steel rod, pushed into the ground at a distance of 2 yd. or 3 yd. from the cable route. Besides simplicity in operation and accuracy of results, other advantages of this method are that the smallest earth leakages can be expeditiously located without interruption to the supply; the apparatus is cheap and simple in construction, while the test may be made by anyone possessing elementary technical skill. The method is applicable to any system of supply, whether direct or alternating. In the case of a two-wire supply it is necessary merely to earth the unaffected conductor to give the required potential-difference surrounding the fault. In the discussion D. Robertson questioned whether the method would do with three-core cables and advocated the smoke test system. He referred to a method which he had found to answer very well. It was similar to a potential test and is shown in Fig. 5. Calling $l$ the distance between $A$ and $C$,

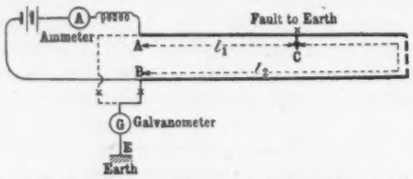



Fig. 5—Localizing Faults in Underground Mains.

$l_2$ that between $B$ and $C$, and the total length of cable $L = l_1 + l_2$, then with a galvanometer connected between $A$ and $E$ the deflection $d_1$ is obtained. By connecting the galvanometer between $B$ and $E$ the deflection $d_2$ is obtained. Then $l_1 = L\frac{d_1}{d_1 + d_2}$, and similarly, $l_2 = \frac{d_2}{d_1 + d_2}$. Toppin, in his reply, said that his method had not been tried on three-core cables, but it is quite suitable on lead-covered or drawn-in cables, if the lead has no breaks of continuity in it. It has been successfully tried on cables 2 ft. 6 in. below the surface in the dryest weather. The ohmmeter and generator method is suitable only before the cables are put into commission. He has used a compass near boxes where the position of cables was apparent. Electric tramways had no effect on the test in his experience.—Lond. *Electrician*, July 14.

*Electric Cables.*—F. Fernie.—In a continuation of his long illustrated serial the author describes in a general way the methods followed in laying cables in ducts, on the solid system or simply armored; also in the shafts of mines. In conclusion he considers records and the allocation of costs.—Lond. *Electrician*, July 15.

### Electrophysics and Magnetism.

*Isolation of Ions.*—R. A. Millikan.—An abstract of a paper read before the American Physical Society on the isolation of an ion. It is a modification of his former method in which water drops were used; for these he has now substituted drops of oil or mercury which do not volatilize. In addition to furnishing an exact determination of the value of the elementary electrical charge (the result of which is not yet given) the use of the method has shown that Stokes' law in air does not apply for droplets having a radius less than 0.00013 cm; further, that the majority of the ions of ordinary dust-free air, both positive and negative, carry the elementary electrical charge. However, ordinary dust-free air contains some ions of both the positive and the negative sign which carry multiple charges. The method is being applied to the study of ionization in gases other than air.—*Phys. Rev.*, July.

*Ions and Electrons.*—M. Joly.—The first part of a review of the development of our present ideas on ions and electrons. The author deals with the conductivity of gases, the mobility of ions, the charge of ions, gaseous suspensions, and disruptive discharges. The article is to be continued.—*La Lumière Elec.*, July 9.

*Absorption of Electrons.*—O. W. Richardson and H. C. Cooke.—A preliminary account of an experimental investigation of the heat developed during the absorption of electrons by platinum. The investigation is to be continued.—*Phil. Mag.*, July.

*Charge of Electrons.*—L. Begeman.—An account of an experimental determination of the charge of an electron by the cloud method. The mean result is $4.668 \times 10^{-10}$ electrostatic units.—*Phys. Rev.*, July.

### Units, Measurements and Instruments.

*Portable Weston Cell.*—H. Tinsley.—An article on methods for rendering the Weston standard cell portable without disturbing its contents. The recommendation of the (Brit.) National Physical Laboratory to ensure that the chemicals shall retain their proper respective positions is to crystallize some of the cadmium sulphate solution so as to form a crystalline plug after the cell has been set up. This plug is so arranged as to crystallize just below the constriction shown in Fig. 6, the constriction acting as a further safeguard by preventing the plug

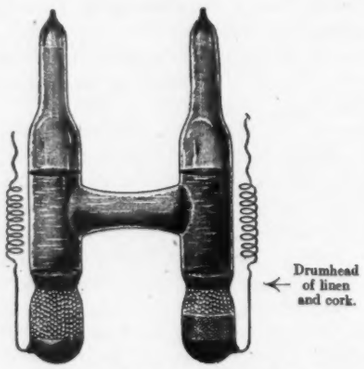



Fig. 6—Portable Weston Cell.

sliding up or down the tube. Special care has, however, to be taken in forming the crystalline plug for cells if they are to be shipped to hot climates. In this case the following method is recommended. When the separate limbs have been filled with their amalgam, small rings of cork are tightly fitted on the inside of the glass limbs, the center hole of these rings being kept as large as possible. Some pure unbleached linen is now carefully freed from its dressing by washing and boiling till no sign of chemical matter can be detected. This is then dried and cut into disks, the same size as the outside diameter of the rings. These disks are then sewn to the bottom of the cork rings, forming miniature drumheads which can be inserted as plugs on the surface of the layered chemicals. These drumheads are now forced firmly on the solid matter and will hold the chemicals in position against even violent handling. In a tropical climate, however, some solid crystals of $CdSO_4$ are sure to be taken up in solution, and the chemicals in the drumhead may become loose, so that it is desirable to add a few crystals of $CdSO_4$ above it to allow for the amount taken into solution. The linen screen does not appear to affect the e.m.f. materially.—Lond. *Electrician*, July 15.

*Weston Cell.*—S. W. J. Smith.—His recent London Physical Society paper in full on the limitations of the Weston cell as a standard of electromotive force. This paper contains an attempt to explain F. E. Smith's recent experiments on the cadmium amalgams of the Weston cells in terms of the theory of solutions. An abstract of this paper has already been given in the Digest.—*Phil. Mag.*, July.

*Frequency Meters.*—O. Martienssen.—A review of various electric frequency meters. The author first deals with the vibratory frequency meters of Hartmann-Kaempf and of Frahm. He then describes another frequency meter of Ferrie, which is a combined ammeter and voltmeter, both instruments being so arranged side by side that the needles of the two instruments cross each other; the point of intersection deter-

mines the frequency, as recently described in the Digest. In another instrument devised by the author himself, a condenser is connected in series with an inductance coil with closed laminated iron core. A voltmeter is connected in parallel with this inductance coil. If the condenser and inductance are properly chosen the current and the voltage at the terminals of the inductance coil increase with the frequency. On the other hand, if the voltage of the supply circuit changes, while the frequency remains constant, the voltage at the terminals of the inductance coil will nevertheless remain unchanged, if the magnetization of the iron is properly chosen, since the increase of the magnetizing current causes a decrease of the self-induction. It is, therefore, possible to calibrate the voltmeter directly in periods, so that it measures directly the frequency, while it remains independent within certain limits of the voltage of the supply circuit. Experiments have shown that voltage variations of 10 per cent above or below the normal value do not affect the indications of the instrument. Variations of the wave form have only a small effect.—*Elek. Kraft. u. Bahnen,* July 4.

*Ten-to-One Ratio of Resistance.*—F. WENNER.—An abstract of an American Physical Society paper on a method for measuring or establishing the 10-to-1 ratio of resistance. The resistances whose ratio is approximately 10 to 1 and whose ratio is to be determined are made the adjacent arms (1) and (2) of a Wheatstone bridge. The other arms (3) and (4) are made up of resistances so arranged as to form an approximate 10-to-1 ratio. The bridge is then balanced by the variation of the resistance of one of the arms and a record is kept of the condition producing the balance. The resistances in the arms (1) and (2) are then interchanged while the resistances in the arms (3) and (4) are put into a different combination (usually without a transfer of any resistance from one arm to the other) so as to make the ratio very exactly one-hundredth of its former value. The bridge is balanced as before and from the two conditions of balance the ratio is easily calculated. The ratio of the resistances in the arms (3) and (4) may be made approximately 10 to 1 and then changed to very exactly one-hundredth of the first value by the use of: (a) 11 nearly equal resistances, 10 of which are used in the arm (3) first in series and then in parallel; (b) seven nearly equal resistances, five in the arm (3) and two in the arm (4) first with the five in series and the two in parallel and then with the five in parallel and the two in series; (c) six nearly equal resistances and one resistance of approximately one-third the mean value of the others. In the latter case three of the nearly equal resistances are used in each arm, first with those of the arm (3) in series and those of the arm (4) in parallel and the smaller resistance in with the series combination, and then with the conditions just interchanged. Here, since the smaller resistance is transferred from one arm to the other, a correction must be applied unless it is very exactly one-third the mean of the other six.—*Phys. Rev.,* July.

## Telegraphy, Telephony and Signals.

*Double Tuning for Wireless Telegraphy.*—H. REIN.—The

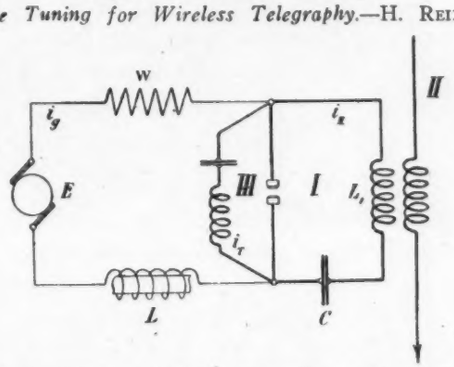



Fig. 7—Diagram of Connections for Double Tuning.

author uses the arrangement shown in Fig. 7. *E* is a direct-current generator, *W* is a resistor and *L* an inductance. *C* is a capacity and $L_1$ and $i_r$ are inductances. Three currents pass through the discharge gap: first the direct current $i_g$ from *E;* second, the low-frequency current $i_r$ of the circuit *III,* tuned to an audible note; third, the high-frequency current $I_{II}$, which is impressed on the antenna. The direct current $i_g$ and the low-frequency current $i_r$ of *III* combined into a pulsating current which changes periodically the resistance of the air-gap in rhythm with the pitch of *III.* The high-frequency discharge of *I* is thereby influenced in such a way that at the moments in which the resistance of the discharge gap is a maximum, numerous partial sparks always pass, while at the moments when the pulsating current becomes a maximum the capacity discharge of *C* ceases. Various photographs show that the tuning can be made quite sharp.—*Phys. Zeit.,* July 1.

*Liquid Microphone.*—F. J. CHAMBERS.—The author, after expressing some views upon wireless telephony in general, proceeds to describe a novel form of transmitter. The high-frequency current is led through an electrolytic path of small dimensions, so arranged that its resistance is varied considerably by the vibrations of a diaphragm, the liquid being maintained in a state of continuous flow. The advantages include faithful speech reproduction, and constant normal resistance with facilities for adapting this to suit requirements. Models have proved capable of taking energy at rates up to 500 watts.

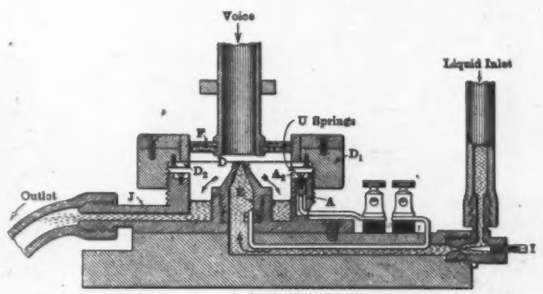



Fig. 8—Section of Liquid Microphone.

Practical results are described. In Fig. 8 a metallic diaphragm *D* is mounted upon a ring ebonite holder $D_1$ in contact with a metal ring $D_2$ secured to the latter. The underside of the holder is turned out and a female thread is tapped into the inner side. The ring is screwed upon *A*, the body of the apparatus, by means of this thread. Inverted *U* springs serve the double purpose of taking up the backlash in this thread and making electrical connection between the diaphragm and a second ring $A_2$, secured to the ebonite body; from this ring a lead is taken out through the wall of the body to one terminal. The diaphragm thus forms one electrode, and the other is shown at *E*, a tubular piece of metal with an upper nipple. The liquid supply is led through a fine adjustment valve *I* to the center of the lower electrode, passing through the latter and the constricted portion between the diaphragm and its lip and is collected in an annular reservoir formed in the body of the vessel *A*, from which it passes by an outlet pipe *J*. The lower electrode is connected by a lead passing out through the body of the vessel to another terminal. The flow of liquid is controlled by the fine adjustment valve *I*, and the distance between the diaphragm and the lower electrode is adjusted by revolving the diaphragm holder. A speaking tube concentrates the sound waves upon the diaphragm, and *F* is a disk of felt which confines these, while allowing the holder to be revolved. —Lond. *Electrician,* July 15.

## Miscellaneous.

*Brussels Exhibition.*—A continuation of the illustrated report of the exhibits at the Brussels International Exhibition. The present installment deals with electrical and engineering exhibits.—Lond. *Electrician,* July 15.

# New Apparatus and Appliances

## ELECTRIC EQUIPMENT OF CHESAPEAKE & OHIO RAILROAD SHOPS AT HUNTINGTON, W. VA.

The machinery in the shops of the Chesapeake & Ohio Railroad Company, at Huntington, W. Va., which was formerly driven by reciprocating engines, has recently been equipped for electric drive.

The new steam station is equipped with turbines, the only reciprocating machinery besides the boiler feed pumps being two two-stage air compressors built by the Ingersoll-Rand Company and the Chicago Pneumatic Tool Company, which furnish compressed air at 100 lb. pressure for the pneumatic drills, hammers and hoists about the shops. Three Curtis steam turbines and one motor generator exciter have been installed.

The turbine equipment consists of the following units: One

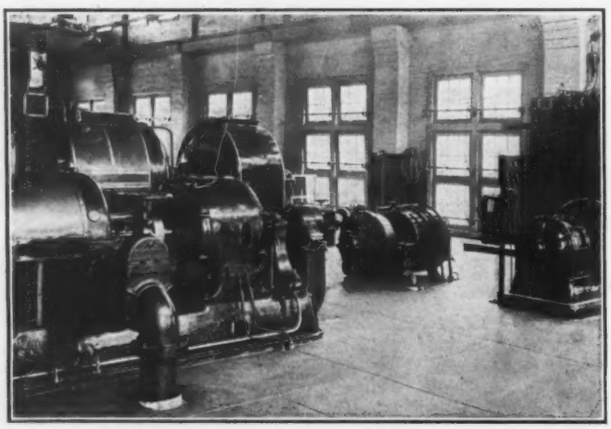


Fig. 1—Turbines in C. & O. R. R. Shops at Huntington, W. Va.

two-bearing, overhung, non-condensing turbine, speed 3600 r.p.m., connected to a 25-kw, 125-volt, direct-current exciter; one four-bearing, three-unit, 100-kw set consisting of one non-condensing turbine, speed 3600 r.p.m., one three-phase, 60-cycle, 480-volt, 100-kw generator and one 4-kw, 125-volt exciter; one three-bearing, four-stage condensing turbine, speed 1800 r.p.m. connected to a 750-kw, three-phase, 60-cycle generator.

All of the turbines are equipped with oil pumps geared directly to the main shaft of the turbine, and the bearings are fitted with oil rings. The 750-kw and 100-kw turbines are equipped with cross-head mechanical valve gear driven directly from the main turbine shaft.

The 750-kw turbine is connected to a Westinghouse-Le Blanc jet condenser, the circulating and rotary air pumps of which are driven by a 75-hp induction motor. The injection water is cooled by a natural draft cooling tower. This arrangement is very satisfactory, as it maintains a vacuum of from 27 in. to 28 in.

The boiler equipment consists of five 275-hp Stirling water-tube boilers, which are equipped with shaking grates and are hand fired. The ash is shoveled from the ash pits into cars and conveyed to a dump. The smoke stack is of reinforced concrete, 200 ft. high, and is provided with a Bushnell damper regulator. Bituminous coal is delivered in railroad cars on a trestle just outside of the boiler room and is dumped into coal bunkers and conveyed through chutes to a point within easy reach of the fireman.

The switchboard is of standard General Electric slate panels, consisting of two machine panels, two exciter panels, four three-circuit feeder panels and one half panel on which a voltage regulator is mounted. The instruments are of the switchboard type.

About 1000 hp of General Electric induction motors is distributed throughout the planing mill, tin shops, pipe shops, machine shop, boiler shop, and round house, ranging from 15 hp to 100 hp each. They are used to drive the different tools, such as band saws, wood planer, lathes, circular saws, drill presses, boring mills, shapers, metal puncher and rolls. Most of the motors are belt-connected. The large planers, turning lathes, drill presses and boring mills are equipped with individual motor drive. The planing mill is equipped with a sawdust and shaving eliminator driven by a 100-hp induction motor which conveys the shavings through tubes into the furnace under the boilers.

The station for charging storage batteries for signals and passenger coaches is equipped with a motor-generator set. The dismantling shop is spanned by a 120-ton four-hook Harris electric crane equipped with four variable-speed induction motors of the slip-ring type.

The buildings are heated by the exhaust steam from the two air compressors, the boiler feed pumps, 25-kw and 100-kw turbines; the condensation from the system is pumped into the boiler feed-water heater. This arrangement puts on the exhaust header a back pressure of from 4 lb. to 8 lb.

The changes made in this plant brought about a saving in coal alone of 50 per cent, which saving will be effected in part by the low steam consumption of the turbines and in part by the obliteration of large shafting and belting losses due to the introduction of a system of motor drive. There was also effected a saving of over 60 per cent in the labor required to operate the plant. This saving is due partly to the improved methods of handling coal and ash and partly to the small number of men required to operate a turbine station. Besides the saving in the cost of coal and labor, there has been a large increase in output of the shops, as 26 locomotives are now being overhauled and rebuilt in one month, whereas 20 was a good month's work previously. During the month of April

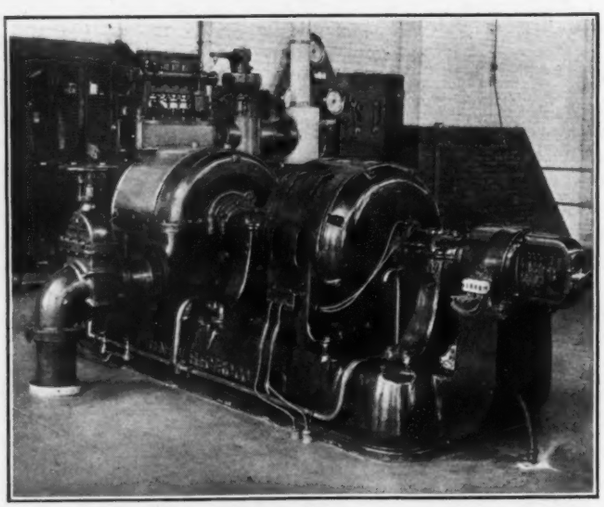


Fig. 2—One of the Turbo-Generating Units.

34 locomotives were turned out, this being the largest number ever repaired in one month. The electric drive has also increased the flexibility of the shops, as any section can be operated independently of the rest. The shops are very well lighted so that the men can work at night to advantage.

The new plant was put in service March 1, 1910. Very remarkable speed was made in installing the switchboard and turbines, as it was just 10 days from the time when they were received until they were placed in continuous service. The engineers were Westinghouse, Church, Kerr & Company.

## SMALL ALTERNATORS.

The accompanying cuts illustrate a type of alternator being placed on the market by the Ideal Electric & Manufacturing Company, of Mansfield, Ohio, in sizes from 20 kw to 200 kw. Particular attention in design has been given to wave-form. The wave-form depends, to a large extent, upon the number of coils per phase per pole, and it will be noted in Fig. 1 that the present type has a comparatively large number of slots. Even in the smaller sizes these generators have at least three slots

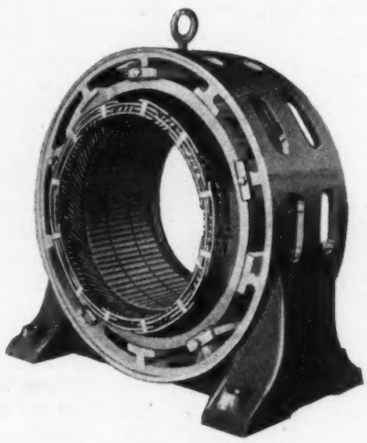


Fig. 1—Stator of Alternator.

per phase per pole in three-phase generators, or four slots in two-phase generators, while in the larger sizes the number of slots is greater. Besides giving more conductors per phase per pole, a large number of slots also has the further advantage that it gives a more even distribution of the flux. This is especially important in small-sized alternators, having open slots. Open slots are used in the generator shown, thus per-

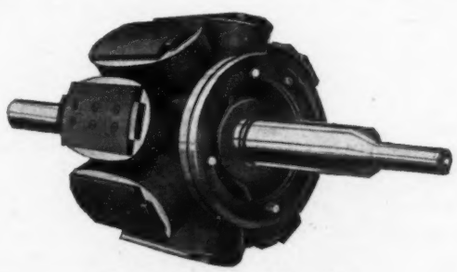


Fig. 2—Rotor of Alternator.

mitting the coils to be form wound and heavily insulated before insertion in the armature. It also has the advantage that in case of a burn-out coils can be easily removed without disturbing the remainder of the winding.

Another cause of poor wave-form is the shape of the field-pole pieces. The lines of force naturally pass from pole to pole through the path of least reluctance, and as the pole tips present the shortest path, the flux will concentrate here, giving an excessive magnetic density unless special pains are taken to prevent this by shaping the pole pieces as shown in Fig. 2. This arrangement is stated to give a practically uniform magnetic path and insure an even distribution of the flux in the pole face at all times.

Another feature in the design of the alternator illustrated is the fact that both bearing boxes are directly bolted to the stator frame. The bearings themselves are of the split, ring-oiled, self-aligning type, which offers a considerable advantage to the user in case it is necessary to remove the rotor for dismantling or making repairs. The oil is contained in large reservoirs, having outside gages to indicate the amount of oil present.

The alternators are designed for continuous operation at 80 per cent power-factor, but their ratings are given on the kva basis of 100 per cent power-factor. It is stated that by the use of carefully annealed and japanned laminations in the armature, and by a liberal use of copper, the machine has been so improved that it gives high efficiencies over a wide range of

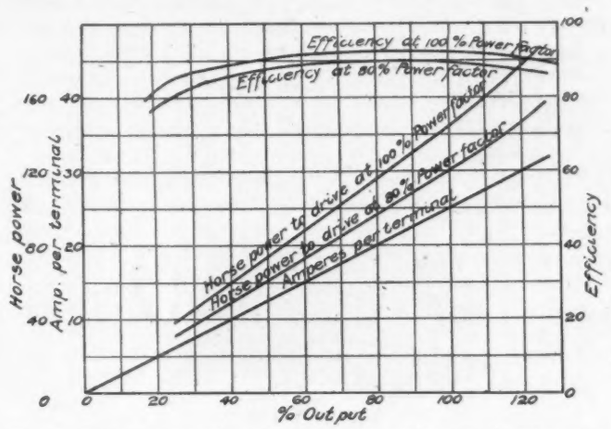



Fig. 3—Performance Characteristic of Revolving Field Alternator.

load. Fig. 3, which gives the test curves of a 100-kva, three-phase, 60-cycle, 2300-volt revolving-field alternator, shows that the efficiency from 50 per cent to 125 per cent load is practically flat, giving a maximum efficiency of 95 per cent at full load. The machines, it is stated, run at full rated load and not less than 80 per cent power-factor without showing a temperature rise of more than 40 deg. C.

## TEST CLIP.

A test clip, which although particularly applicable to telephone work is not necessarily limited to such work, is shown herewith. The device is manufactured by R. S. Mueller & Company, Cleveland, Ohio, and may be used for shop work testing, where a ready means of making a test connection is required, or for making pressure tests on electric light circuits. In the latter case it is usual to slip a piece of soft-rubber tubing over the device and leave only the jaws exposed. No brass is used in the clip; the outer members are made of No. 20 semi-hard cold-rolled steel, and the inner members are made of blued spring steel with the point of application near the jaws. A long leverage produces a powerful bite, and there are no projecting parts to catch on things when coiling up the different wires. The clip stands straight without sagging on the round

Test Clip.

pins of cable terminals, and the nose is so thin that one may test on telephone distributing frame terminal punches set on 3/16 in. centers without short-circuiting the adjacent punches. The clip is said to be applicable for wire as small as No. 40, and to switchboard or storage-cell lugs 5/8 in. thick. In bare-wire testing the side jaws are used, and often in crowded quarters a contact can be made with the side jaws where there would not be room to apply the nose. The teeth mesh, so that a good test contact can be made on fine wire, and on coarse wire or pin terminals there are always three points of contact. The clips are sherardized so as to take solder freely. In fastening the cord to the clip, the bared end of the conductor is threaded through the small hole in the heel, and the wire is pulled up snug so that the insulation comes up into the trough. After the wire is soldered to the clip, the up-turned lips are pinched down over the cord by pliers.

## BELL-RINGING TRANSFORMERS.

Where alternating current is available, bell-ringing transformers may be used to save the expense, care and inconvenience of batteries for the operation of electrical bells and similar apparatus. They not only supply current for bells, but are equally valuable and convenient for operating door locks, annunciator call systems, spark coils, burglar alarms, thermostats for regulating the heating of buildings, electric gas lighting systems, etc. They eliminate all danger encountered by the use of the higher voltages.

The transformer shown in the accompanying cut, known as the "Hawthorn" bell-ringing transformer and made by the

Bell-Ringing Transformer.

Western Electric Company, is compact and rugged in construction, and the windings are insulated so as to withstand many times the voltage to which they are subjected in operation. By an ingenious arrangement of the windings it has been made impossible to injure either the transformer or bells should the bell circuit become short-circuited. The transformer is approved by the National Board of Fire Underwriters. The power consumption of this same type of transformer on test is stated to have proved too small to register on the usual form of watt-hour meter.

## FAULT-FINDER.

The Roller-Smith Company, New York City, has brought out two forms of slide-wire bridges for fault-finding work. By winding the wire spirally around an insulated mandrel bent into the shape of a circle, a slide-wire resistor having a resistance of over 200 ohms is obtained. The resistor is mounted underneath the top plate of the instrument, where it and the movable contact, manipulated by turning the central hard-rubber button, are protected from damage and kept free from dirt.

Fig. 1—Instrument for Locating Faults.

The fault-finders are made in two styles, the galvanometer model having self-contained batteries and a very sensitive d'Arsonval galvanometer, while the plain model has neither batteries nor galvanometer, but is supplied with terminal posts so that an external current source and external means of detecting balance (generally a telephone receiver) may be employed. In the first type the galvanometer is permanently secured in place within the casing, the top plate in the batteries being removable without disturbing it or touching any wire connections. It is equipped with a zero adjuster operable from outside. The plain model has a push-button key in the circuit to the external means of current detection, so that if the telephone receiver is used for that purpose, the manipulation of the key will cause the clicking necessary with this mode of working. The range of resistance measurements covered by both models is from zero to 5000 ohms, and each is equipped with two scales, one giving resistance values and the other percentage values used when locating grounds. In both models the standard 100-ohm resistance coil is adjusted to one-tenth of 1 per cent, and the slide wire tested for uniformity of resistance. The scales are hand calibrated.

Wiring diagrams of the galvanometer model and the plain model are shown in Figs. 2 and 3. In measuring resistances, the terminals of the circuit to be measured are attached to binding posts 1 and 2, and the switch $D$ is turned to position $X$. The central hard-rubber button is turned until on depressing the push button $K$ no galvanometer deflection is obtained or no click is heard in the telephone receiver. The value of the resistance under measurement is that indicated by the position of the needle relative to the outer of the two scales. In locating grounds, the grounded conductor must be looped or coupled at a distant station to a good return conductor, the two free ends of the circuit thus formed being attached at the home station to posts 1 and 2. The post $G$ is also connected to a ground wire. With the switch $D$ at the position $X$, the resistance may be measured as already indicated. Having thus found the resistance of the loop, and knowing the size of the wire forming it, the length in feet may be calculated by reference to a wire table. The switch $D$ is then thrown to the position $T$, and a galvanometer balance obtained by rotating the central hard-rubber button, and depressing the hard-rubber button $K$ as before. When the balance is obtained, the distance from the point of test to the fault is shown by the position of the needle

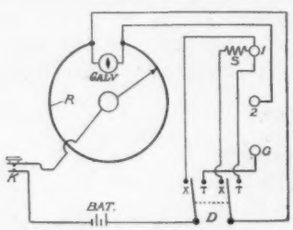



Fig. 2—Wiring Diagram of Galvanometer Model.

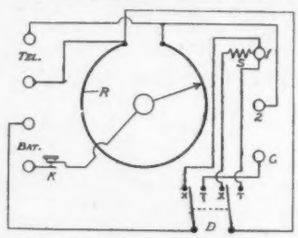



Fig. 3—Wiring Diagram of Plain Model.

relative to the inner of the two scales, in percentage of length of line from test station to distant station. The inner scale is marked one-half with green numerals and one-half with red numerals, and the binding posts 1 and 2 are distinguished by buttons similarly colored. This is to prevent confusion in interpreting the indications, so that if the fault is indicated as being at 80 per cent of the line length out on the red scale, it will be understood that this is on the wire attached to the red post and vice versa. Having the percentage of line length from this test, and the length of the line from the test preceding, the distance in feet to the fault is readily calculated. The galvanometer type of instrument measures 7½ in. x 6½ in. x 5 in. and weighs 7 lb., the plain-type instrument measures 8½ in. x 6½ in. x 3½ in. and weighs 6 lb.

## A TON OF PLATINUM.

It is an interesting fact, perhaps not generally known by operating telephone men, that precious metals, such as platinum, gold and silver, and even precious stones, such as diamonds, are used extensively in the manufacture of telephone apparatus. The Western Electric Company, the largest manufacturer of telephones in the world, uses upwards of one ton of platinum each year. When it is considered that the value of platinum is 30 per cent greater than that of pure gold, it will readily be seen that this expensive precious metal would not be used extensively unless results justify it. The contact points of all Western Electric telephone apparatus are made of platinum.

## ALTERNATING-CURRENT OIL CIRCUIT-BREAKER.

The Westinghouse Electric & Manufacturing Company, a few years ago, placed on the market a type of oil circuit-breaker designed for potentials not exceeding 600 volts and with a current-carrying capacity of from 10 amp to 300 amp, the breaker being designed for mounting on a wall or post or any location convenient to the operator. Owing to the success of the principles of operation embodied in this circuit-breaker, the line has been extended to include breakers of the same current-carrying capacity adapted for switchboard mounting and for use on alternating-current circuits having potentials as high as 2500 volts.

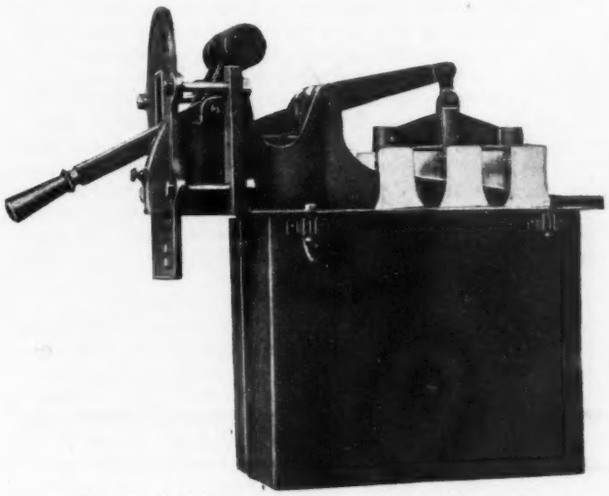


Fig. 1—2500-Volt Oil Circuit-Breaker Complete.

The new type, in addition to embodying all the distinguishing features of the old 600-volt type, possesses several new features, the most prominent of which are the inverse time element and the "full automatic overload" release attachment. The overload release trip coils are suspended from the frame of the breaker, immersed in oil and connected directly in series with the line. The plungers of these trip coils are retarded in their action by a device giving the circuit-breaker an inverse time-element. The time-element introduced is sufficient to permit the use of this type of circuit-breaker for motor-starting service.

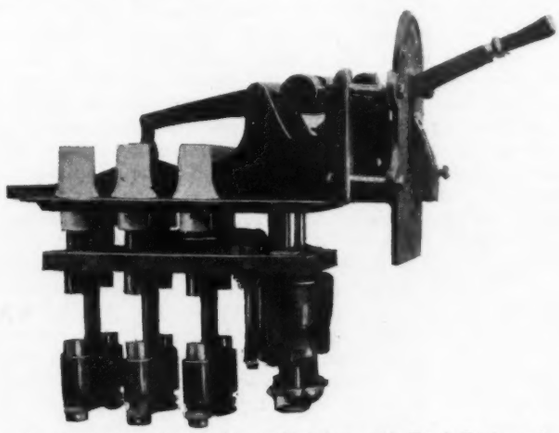


Fig. 2—2500-Volt Oil Circuit-Breaker with Tank Removed.

The mechanism is known as "full automatic overload," that is, it is equipped with a device that renders it impossible to close the breaker or to hold it in the closed position while a continued abnormal overload condition or a short-circuit exists on the line. The time-limit device, referred to above, permits the breaker to be closed under a momentary overload or rush of current such as is incident to starting an induction motor or throwing the controller to "running" position.

An under-voltage release attachment which opens the breaker whenever the line voltage falls below a certain predetermined value can also be applied to this type of oil circuit-breakers. It consists of a magnet coil connected directly across the line for voltages not exceeding 600 and through potential transformers for voltages higher than 600. This coil is self-contained, and is so designed that it may be attached to the breaker without any modification in the mechanism.

While the 600-volt style has a single break to each pole, in the 2500-volt style there are two upper and two lower contacts for each pole, thus securing a double break per pole. The contacts consist of cylindrical brass rods, the lower ones being backed up by individual spiral springs to insure good contact and form the well-known "butt" contact type. This method, familiar in the multiple-unit system of control on heavy street-railway equipment, has been adopted with great success in oil circuit-breaker practice. It insures good contact always and prevents any possible failure due to eating away of the contacts by continued arcing. The compression springs mentioned take up any wear that may occur and render the contacts self-aligning.

## SOME NEW APPLIANCES EXHIBITED AT THE OHIO CONVENTION.

At the Ohio Electric Light Association convention at Cedar Point, on Lake Erie, last week, some comparatively new appliances were exhibited in addition to a considerable amount of apparatus which has been on the market for some time. The Westinghouse Electric & Manufacturing Company showed a general utility motor which is a small motor for household use. It is provided with a combination chuck to which either an emery wheel or a buffing or polishing wheel may be attached so as to do either grinding or polishing. The motor is provided with a base to fasten it down when it is to be used for miscellaneous purposes. It also has a flexible shaft for grinding and polishing and a massage attachment. By pulling out a plug and revolving it 90 deg. the direction of rotation can be reversed.

The company also showed the new wire type of tungsten lamp which will withstand about the same abuse as a carbon-filament lamp; this lamp was exhibited for the first time at the National Electric Light Association convention. The company established a substation on the boardwalk for converting direct-current supply of the Cedar Point power plant into alternating current for operating a circuit of series-tungsten lamps which were hung on the beach.

Another recent development is a combined oil-switch and circuit-breaker for three-phase motor circuits for electromotive forces up to 2500 volts. This switch is described in detail in the preceding article. This is designed to take the place of switch and fuse otherwise required. The new electric iron for tailors, which takes energy only when placed in its standard, contacts being made through heavy lugs, was also shown.

The Sterling Electric Manufacturing Company showed a number of 400-watt and 500-watt tungsten lamps in connection with enameled iron street hoods and reflectors adapted for such lamps.

The General Electric Company displayed one of its new chafing dishes in which the heating element and base are separable from the chafing dish proper. The base is provided with a regulating switch. A new soldering iron using a General Electric heating element was exhibited.

The Peirce all-steel brackets and pole hardware which are now made by Hubbell & Company, of Pittsburgh, have been extensively used in telephone work and also in electric lighting work in Chicago. These bracket and pole fittings were exhibited for the second time at an electric light convention. They are made from various standard steel sections, being both cheap and reliable. Brackets for attaching to building and for taking off service wires from the ends of cross-arms were shown by the company.

# Industrial and Commercial News

### The Week in Trade.

TRADE was probably even more quiet last week than it has been at any time during the summer season. The wholesalers and jobbers report that orders are fewer and there is less inquiry than is customary even during the mid-summer period. Distribution through retailers is disappointing, and while there are many buyers in the central markets, the condition is such that they are extremely conservative. The sharp break in the securities market followed by a quick recovery had an effect of further unsettling the business situation. The extensive drought in some portions of the country and the excessive moisture in others has made the reports as to crops irregular and somewhat disconcerting. While it is generally believed that eventually the average crop yield will be good, weather conditions have been such that many sections are feeling discouraged. Business men generally are inclined at the present moment to await the forthcoming government crop report. Among the industrials, a rather better demand was reported for finished iron, steel, copper and some makes of cotton goods. This improvement is probably based upon the advance in raw material. Pig-iron remains very quiet and prices are still easy. The curtailment of output does not appear to have gone far enough to buoy quotations, and it is said that stocks are accumulating at some points. Orders for railroad equipment continue to come in, but are generally limited in size. The roads appear to be buying only to meet actual necessities. Collections are still slow and renewals are asked in some sections of the South and West. Business failures for the week ended July 28 as reported by *Bradstreet's* were 198, against 215 the previous week; 223 in the like week of 1909; 275 in 1908; 142 in 1907; and 170 in 1906.

### The Copper Market.

SPECULATION was active in copper last week, and at some periods of the week the market was decidedly feverish. Orders for standard were stimulated by continued rumors of curtailment in production, and many orders for electrolytic were received from actual consumers, who became impressed with the opinion that they would not be able to buy copper at such reasonable rates later on. The net results in prices for the week were advances both in standard and electrolytic of about one-quarter of a cent per pound. The figures obtained from market reports indicate that during the week an aggregate of about 35,000,000 lb. was taken, largely for export. A large portion of this was for September and October delivery. Much of the export copper was taken for the purpose of covering speculative transactions in Europe.

| | Bid. | Asked. | price. |
|---|---|---|---|
| Spot | 12.10 | 12.20 | ..... |
| August | 12.10 | 12.15 | 12.12½ |
| September | 12.10 | 12.20 | 12.15 |
| October | 12.15 | 12.25 | 12.20 |
| November | 12.22½ | 12.25 | 12.25 |

The London market Aug. 1 was as follows:

| | Noon. £ s d | Close. £ s d |
|---|---|---|
| Standard copper, spot | 55 10 0 | .. . . |
| Standard copper, futures | 56 2 6 | .. . . |

Extreme fluctuations for this year:

| | Highest. | Lowest. |
|---|---|---|
| Standard | 13.50c | 11.70c |
| London, spot | £62 0 0 | £52 15 0 |
| London, futures | 65 18 9 | 53 7 6 |
| London, best selected | 65 10 0 | 57 15 0 |

The speculative movement was well timed to carry the market upward before the unfavorable statistics, which it is said will be shown when the July report of the Copper Producers' Association is made public, could have their effect upon the market. In the mean time there continues to be a general belief that the producers are actually intending to curtail the production of copper, and it is claimed that some of the largest companies have already signed agreements whereby the smelter output will be reduced about 7,000,000 lb. per month, and that other companies are considering reductions which, if carried out, will make the total curtailment of production about 25 per cent. If this program is adopted the copper market will regulate itself. The average consumption for the nine months of the present year has been about 75 per cent of the production. If the curtailment that is now promised is carried into effect, the production of copper will about equal the consumption, and the distressing accumulation of surplus will cease. The increased buying by domestic consumers during the past week was largely due to their faith in the promises of reduction, for if the mines ever actually quit producing to the extent of 25 per cent, copper will not be obtainable at the present figures. At the same time it is well to mention that quite a number of large copper producers are skeptical as to the good faith of the curtailment program. During the past week several have been reported as saying that they believed that any announcement of the curtailment agreement was intended to strengthen the market, and that eventually as much copper would be produced as ever. The imports continue to be quite heavy, and the indications are that the amount received during July will be about 14,000 tons. Exports for the month were 22,875 tons. The daily call on the Metal Exchange August 1 quoted standard copper as per the accompanying table.

### Industrial and Commercial Notes.

**Apparatus for New York Central.**—The New York Central Railroad Company has asked for bids for four 2000-kw rotary converters. E. B. Katte, chief engineer of electric traction of the company, says that three of these rotaries are to be used in the substation which is now being constructed at Irvington, and one will be placed in the present substation at Glenwood. It is hoped to have them all in service by next spring. He also says that it is the purpose of the company to extend if possible within the present year the electric zone from Yonkers to Hastings, a distance of about 4 miles, for the service of multiple-unit trains. The electric zone will eventually be extended to Croton, and a new substation will be erected at Ossining. When the entire electrification is completed, a transfer station will be established at Croton to accommodate the steam locomotives, and all trains will be brought from that point into the city by electricity. It is not expected that this entire work can be finished for several years.

**New Westinghouse Foundry.**—The Westinghouse Electric & Manufacturing Company has purchased 70 acres in Trafford City, Pa., adjoining the property owned by the Westinghouse Machine Company. A new foundry will be erected on this property, and will be completed within a year. It is said that when this foundry is ready for operation it will be one of the largest in the world. It will employ at least 2,500 men, and it is said that the foundry at Cleveland and the one on the north side of Pittsburgh will be centralized in the new location, thus placing all of the foundries of the Westinghouse interests in one locality. The new foundry will be connected with the other Westinghouse companies by what is known as the Interworks Railroad. The ground purchased for the new site cost in the neighborhood of $250,000.

**Vermont Marble Company.**—Contracts have been made by the Vermont Marble Company for the construction of a 35,000-volt transmission line from Weybridge, Vt., to West Rutland. A generating station will be erected at Weybridge which will be equipped with two 800-kw generating units. The Marble company has a 2250-kw hydraulic plant at Proctor and a 500-kw steam plant at West Rutland. Arrangements are being made to parallel these plants with a 10,000-volt transmission line.

**More Telephones on the Santa Fé.**—The Atchison, Topeka & Santa Fé Railroad, which was one of the first in the West to take up the telephone for train dispatching, has almost completed an installation which will give it in the neighborhood of 7000 miles of line operated under the telephone system. The Western Electric Company instruments and selectors will be used in this service. The railroad recently bought 600 of these selectors.

**Philadelphia Rapid Transit Company.**—Contracts have been signed between the Delaware County Electric Company, Media, Pa., and the Beacon Light Company, Chester, Pa., both subsidiaries of the Philadelphia Electric Company, and the Philadelphia Rapid Transit Company under which the electric companies will supply all the energy for railway purposes, for the line operating Delaware County.

**Sierra Pacific Electric Company.**—An offer is being made to the public of the $1,000,000, 6 per cent cumulative preferred and the $550,000 common stock of the Sierra Pacific Electric Power Company. The offer is made in blocks of 10 shares of preferred and five shares of common for the lump sum of $950. This is the recently organized holding company which owns all the stocks of the electric light and power companies of Reno, Sparks, Virginia City and Carson City, Nev. The companies combined control the entire gas business of Reno, Sparks and Carson City and do a large business with mines and mills in that entire section. Concerning the property Stone & Webster say: "The present developed water power amounts to 7300 hp, which is insufficient to supply the increasing demand for electric power. A new plant of 9000 hp rating will be constructed at once, there already being a demand for a substantial amount of this additional power. It is estimated that ultimate developments aggregating 150,000 hp are available." The mining interests in this section have increased very rapidly with the introduction of hydroelectric service, the high cost of generating energy by steam having made it impossible to work many of the low-grade ores. In addition to the mining interests there is a great increase in irrigation in this portion of Nevada. Last year 32,000 acres were reclaimed by irrigation and it is said that 200,000 acres in addition can be put under cultivation, as soon as electric energy for pumping can be obtained.

**Allis-Chalmers Company's Business.**—According to an official of the Allis-Chalmers Company, the orders being booked by that concern are very satisfactory. The business for last month, it is stated, up to July 25, almost equaled the business for the entire month of June, and it was expected that by the end of the month it would far exceed it. June did not quite equal May, which was the banner month, but July is likely to exceed May. The orders taken in May were at the rate of $29,000,000 per year. "Our recent business," said this official, "has been exceptionally good on large steam turbines and turbo-generator sets. We are not selling as much mining machinery as was sold last year, but we are selling more than enough other apparatus to make up for it. We recently sold the city of Jacksonville, Fla., a 1500-kw steam turbine; to the Mexico Northwestern Railway Company three big units; Flatbush Gas Company, Brooklyn, 3000-hp turbine; Houston (Tex.) Lighting & Power Company, 4000-hp steam turbine, and Firestone Tire & Rubber Company, Akron, Ohio, 2000-hp turbine. These are only a few sample orders which I can remember without looking up the records. We are also selling a large number of small motors; one order we recently booked being from the United States Government for use at the Indian Head, Md., proving ground."

**International Steam Pump Company.**—The International Steam Pump Company is taking active measures to increase its manufacturing facilities and to effect greater economies in the handling of its western business. It has recently purchased the F. M. Prescott Steam Pump Company of West Allis, Wis., and during the present fiscal year also acquired the Jeanesville Iron Works Company and the Denver Rock Drill & Machinery Company. In addition to this the company is spending $750,000 for construction work at the plant of the Power & Mining Machinery Company in Milwaukee, and $850,000 for general improvement in other plants. The company now has 10 subsidiaries with factories in New York, Massachusetts, Ohio, Pennsylvania and Wisconsin. Officials of the company say that business is very satisfactory and that if it continues at the present rate until the end of the next fiscal year, March 31, 1911, the surplus earnings of the company should amount to at least 7 per cent on the common stock. The last disbursement on this stock was made April 1, 1905.

**Tunnel to Staten Island.**—Stephen M. Hoye, president of the New Jersey & Staten Island Junction Railroad Company, announced last week that plans are now in course of preparation for a tunnel under the Narrows to connect Staten Island and Long Island. It is proposed that this tunnel shall be connected with the new Fourth Avenue (Brooklyn) subway. Mr. Hoye said that an act of Congress passed in 1890 gave his road a perpetual franchise that authorized the construction of a tunnel under New York Bay between the town of Middletown, Richmond County, and New Utrecht on Long Island. Mr. Hoye said: "We are now in conference with a firm of engineers, who assure us that they can construct a tunnel under the Narrows that will be as wide as Broadway from curb to curb, and large enough for automobiles, carriages and railroad tracks. The distance under the Narrows is less than two miles, and the engineers say the tunnel can be constructed within a year at a cost of $6,000,000.

**Cole-Ryan Copper Combine.**—It is said that a plan has been formed for the consolidation of the Calumet & Arizona and the Superior & Pittsburgh copper mining properties, both of which are under the management of the Cole-Ryan interests. It is said that the consolidation will be based upon an examination by three disinterested engineers, and there is a belief that such a combination will be on the basis of four shares of Superior & Pittsburgh for one share of Calumet & Arizona, or that this proportion will be carried out in a new company which will take over both properties. Such a consolidation would give the Superior & Pittsburgh an ownership in an up-to-date smelting plant, and would greatly increase the life of the Calumet & Arizona.

**International Business Directory.**—The Bureau of Manufactures of the Department of Commerce and Labor has in preparation a "World Trade Directory," which will be published by subscription at the price of $50. It will contain about 125,000 names of business houses in foreign countries engaged in foreign trade, which have been selected and classified from lists compiled by consular officers and special agents of the Bureau. A subscription blank will be forwarded upon application to the Bureau of Manufactures, Washington, D. C.

**Electric Cranes for Docks and Wharfs.**—According to an American consular report an expenditure of $88,703 has been authorized by the Minister of Public Works in a European country for the purchase of electric cranes for docks on a certain river. Tenders will also be received until October 12 for furnishing one 10-ton and seven 5-ton electric wharf cranes for an African port. Detailed information can be obtained from the United States Bureau of Manufactures by referring to the file numbers 5274 and 5284.

**Electrical Construction.**—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Marseilles, Ill.; Baltimore, Md.; Ozark, Ark.; Toluca, Mex.; Franklinville, N. Y.; San Leandro, Cal.; Nashua, N. H.; Proctor, Vt; Brooklyn, N. Y.; Cleburne, Tex.; Estevan, Sask., Can.; Whitesboro, Tex.; Washington, D. C.; Oklahoma City, Okla.; Buffalo, N. Y.; Cheyenne, Wyo., and Canton, Maine.

## *Financial.*

### THE WEEK IN WALL STREET.

AFTER the extreme demoralization of ten days ago, the Wall Street market has shown signs of a steady recovery. On July 26-27 there was in evidence an enormous pressure to sell, and more than 110 stocks made new low levels for the year. The liquidation was insistent, and there was apparently no effort on the part of the heavy moneyed interests to check the downward course. Quite a number of

NEW YORK.

| | July 25. | Aug. 1. | Shares sold. | | July 25. | Aug. 1. | Shares sold. |
|---|---|---|---|---|---|---|---|
| All.-Ch. | 8½ | 8 | 1,300 | Int.-Met., pfd. | 46½ | 42¾ | 39,400 |
| All. Ch., pfd. | 28 | 28 | 400 | Mackay Cos. | 80 | 82¼* | 800 |
| Amal. Cop. | 58⅜ | 60⅝ | 312,060 | Mackay C.,pf. | 73* | 72¼* | 200 |
| Am. D. T. | 20½* | 20½* | —— | Man. Elev. | 128½ | 128* | 823 |
| Am. Loc. | 31¼ | 33 | 14,100 | Met. St. Ry. | 15* | 15* | —— |
| Am. Loc.,pfd. | 105 | 105 | 400 | N.Y.&N.J.Tel. | 139¼* | 139½* | —— |
| Am. Tel. & C. | 71½* | 71½* | —— | Steel, com. | 64 | 66⅛ | 1,138,075 |
| Am. T. & T. | 131½ | 130 | 16,855 | Steel, pfd. | 113¼ | 113½ | 22,270 |
| B. R. T. | 73⅛ | 73½ | 55,415 | W. U. T. | 59½ | 60 | 3,790 |
| Gen. Elec. | 139 | 138* | 6,100 | West'h., com. | 53 | 54½ | 7,100 |
| Int.-Met. | 16 | 15⅝ | 30,700 | West'h., pfd. | 115* | 115* | —— |

PHILADELPHIA.

| | July 25. | Aug. 1. | | July 25. | Aug. 1. |
|---|---|---|---|---|---|
| Am. Rys. | 42* | 42* | Phila. Elec. | 14⅝ | 14⅝ |
| Elec. Co. of A. | 11⅝* | 11¼* | Phila. R. T. | 17 | 18 |
| Elec. St. B'ty. | 48 | 47½ | Phila. Trac. | 82½* | 83 |
| E. S. B'ty, pfd. | 30* | 30* | Union Trac. | 42⅝ | 43 |

CHICAGO.

| | July 25. | Aug. 1. | | July 25. | Aug. 1. |
|---|---|---|---|---|---|
| Chi. City Ry. | 180* | 180 | Chi. Tel. Co. | 118* | 117 |
| Chi. Rs., Ser. 1. | 70* | 70* | Met. El. Co. | 20 | 20* |
| Chi. Rs., Ser. 2. | 15* | 15* | Met. El., pfd. | 60* | 60* |
| Com. Edison. | 109¾ | 111 | Nat'l Carbon. | 115* | 115 |
| Chi. Subways. | 2½ | 2⅞ | Nat'l Car., pfd. | 115 | 118¼ |

BOSTON.

| | July 25. | Aug. 1. | | July 25. | Aug. 1. |
|---|---|---|---|---|---|
| Am. T. & T. | 131¾ | 130⅞ | Mex. Tel. | 5¼ | 5¼* |
| Cum. Tel. | 141* | 140 | Mex. Tel., pfd. | 6¼ | 6* |
| Edison E., Ill. | 255 | 253 | N. E. Tel. | 132¼ | 130½ |
| Gen. Elec. | 139¾ | 140 | W. T. & T. | 15¾* | 15½ |
| Mass. E. Ry. | 14½ | 14¾ | W. T. & T., pfd. | 86 | 86* |
| Mass. E. Ry., pfd. | 79* | 79* | | | |

* Last price quoted.
Shares sold for four days, July 25 to July 30.

stocks broke July 26 from 5 to 10 points, and at times the exchange floor gave evidences of serious demoralization. The following days the market recovered, and since that time the tone has been fairly strong, although prices have not advanced to any considerable extent. The cause assigned for the sudden panic was the failure of a large syndicate which was operating in Lehigh Valley, Wabash and Missouri Pacific to meet its many engagements. This syndicate was headed by Dr. F. S. Pearson, and according to general rumor had for its purpose the establishment of another great transcontinental line. There was no failure, in a financial way, recorded against the syndicate, but it was made known that the banking firm of Kuhn, Loeb & Company had taken over its enormous holdings. The break in the market occurred when it became known that the Pearson syndicate could not carry out its original program, and the recovery occurred when it became known that such a substantial banking firm as Kuhn, Loeb & Company had taken over the holdings. There was at no time any necessity for throwing any of the syndicate's holdings on the market, and the demoralization was more largely due to the hysterical condition of Wall Street traders than to any real danger. The physical conditions of the country are not in favor of lower prices, but on the other hand the outside public seems to be entirely absent from the market, and outside buying cannot be counted on even when prices for securities are low. The money market continues to be entirely satisfactory so far as rates are concerned, and so far as the financial condition of the banks is concerned. At the same time, bankers are not particularly encouraging small dealers to enter the market. Money seems to be low largely because very few people have any use for it, either in a business or speculative way. Quotations Aug. 1 were call 1½@2 per cent; 90 days, 4 per cent. The quotations in the table are those of the close Aug. 1.

## Financial Notes.

**Louisville's Power Merger.**—The merger of light, heat and power companies in the city of Louisville, Ky., which was referred to in our issue last week, has not yet been completed. The main point of difficulty at the present time seems to be the question of the capitalization of the new company. All of the concerns involved are anxious for the merger. At the present time the Louisville Gas Company has outstanding $3,600,000 stock and $500,000 bonds; the Louisville Light Company has $3,000,000 stock and $2,500,000 bonds; the Kentucky Heating Company has $3,913,600 stock and $100,000 bonds; the Kentucky Electric Company has $600,000 stock and $400,000 bonds; the George G. Fetter Company has $300,000 stock, making the total capitalization for all of the companies $14,913,600. The city authorities are insisting upon a definite schedule of rates, and argue that the union of the companies will so simplify operation that economies will be made possible. The franchise of the Kentucky Electric Company at present stipulates that the rate for lighting be 9 cents per kw-hour and for power 4 cents, and the city has the right to reduce this rate when reduction seems justified. In the proposed charter of the merger company, which is now under consideration, there is no such provision except that rates may be adjusted every three years by a commission. The old charter of the Louisville Light Company provides that the city must be furnished with lamps for public lighting of such capacity and power as the authorities may determine, at a price not to exceed $67 a lamp per year. The officials of the present companies claim that the rates in Louisville are now lower than in any other city of its size in the country.

**Chicago Traction Merger.**—There appears to be a serious hitch in the program of the syndicate which is attempting to merge the Chicago Railways Company with the Consolidated Traction properties. The holders of Series One certificates of the Railways company have been asked by a protective committee to unite in a protest to the board of directors and trustees of the company, and to Judge Grosscup against fulfillment of the agreement entered into between the Railways company and the holders of the securities of the Consolidated Traction Company. In addition to this, Judge Cutting, of the Probate Court, has denied the petition of the executor of the Yerkes' estate, asking that the claim of that estate be compounded in accordance with a certain arrangement proposed, amounting to about 50 cents on the dollar. The amount of the underlying bonds held by the Yerkes' estate is in excess of $5,000,000. The judge has upheld the contention of Mrs. Yerkes as against the executor, who proposed to enter the reorganization plan as outlined. Chairman Blair of the syndicate intimates that at the present time his plans are held up indefinitely, and will continue to be held up until the various interests agree upon a fair basis of valuation. He says that while the New York financiers are willing to furnish the capital necessary for the undertaking, they want assurance that they can get a fair return on their money.

**Massachusetts Electric Companies.**—The statement of earnings of the operating companies of the Massachusetts Electric Companies for the nine months which ended June 30 was by far the best exhibit for such a period that the concern has ever issued. The surplus applicable to dividends for this period was $338,365 larger than for the same period in the previous year. The remarkable showing, it is claimed, was the result largely of the improved operating efficiency of the system. Although the gross earnings were increased nearly $400,000, or about 7 per cent, operating expenses were increased less than $70,000, or but little more than 1 per cent. Large amounts have been spent upon the properties for construction and reconstruction in the past several years, and it is believed that the companies will be able to continue the good showing made during the past nine months, and thus be in a position to increase their dividends. The Railroad Commissioners of Massachusetts have required that the fiscal year of street railway companies end with June 30, and the figures for this nine months therefore complete the fiscal year for the electric companies.

**Charleston (S. C.) Consolidated Railway & Lighting Company.**—The recently organized Charleston Consolidated Railway & Lighting Company, which is owned by the United Gas & Improvement Company, of Philadelphia, has taken over under a 99-year lease the property of the Charleston Consolidated Railway, Gas & Electric Company. The lease guarantees rentals sufficient to pay 6 per cent dividends on $500,000 of preferred stock, and dividends on $1,500,000 common stock as follows: Four per cent to July 1, 1911; 5 per cent to Jan. 1, 1913, and 6 per cent thereafter. It also guarantees the interest on outstanding bonds. The officers of the company are: T. H. Gadsden, president; G. H. Waring and Walton Clark, vice-presidents; W. F. Douthirt, secretary, and Lewis Lillie, treasurer. The last three named are officers of the United Gas & Improvement Company.

**Illinois Valley Gas & Electric Company.**—Russell, Brewster & Company, of Chicago, are offering $500,000 of 6 per cent cumulative preferred stock of the new Illinois Valley Gas & Electric Company at $85 a share, netting 7.06 per cent, with a bonus of 25 per cent of common stock. Samuel Insull is president of the Illinois Valley company, which has acquired a number of gas and electric generating plants and distributing systems located in and near Streator, Ill. The company will be closely affiliated with the Economy Light & Power Company of Joliet, of which Mr. Insull is also president. Charles A. Munroe, manager of the Economy company, occupies a similar position in the organization of the Illinois Valley company.

**Steel Earnings Higher.**—The report of the United States Steel Corporation for the quarter which ended June 30 last shows net earnings of $40,170,960, as compared with $37,616,876 for the previous quarter. Unfilled orders on the books were for 4,257,794 tons, which is more than 1,000,000 tons less than the unfilled orders on the books on March 1. The Board of Directors decided at the meeting at which the report was made public that the officers shall hereafter on the 10th of each month make public the aggregate tonnage of unfilled orders on hand at the close of the previous month.

**Roland Telegraphic Company Receivership.**—The Roland Telegraphic Company, of Baltimore, a corporation formed about 10 years ago to exploit the multiplex telegraphic printing machine invented by the late Professor Henry A. Rowland of John Hopkins University, has gone into the hands of a receiver. The assets are given to be $257,621 and the liabilities $418,418.

**Safety Insulated Wire & Cable Company.**—Official announcement has been made that at a recent special meeting of the stockholders of the Safety Insulated Wire & Cable Company, of New York, the capital stock was reduced from $1,500,000 to $750,000. The stockholders have exchanged their old certificates for the new ones. The control of the company is held by H. E. Huntington, who is chairman of the board.

**United Railways of St. Louis.**—A report of the United Railways Company of St. Louis for the first six months of 1910 shows a surplus available for dividends of $405,777, as compared with $555,746 for the corresponding period last year. This decrease, the report declares, is attributed entirely to higher operating costs and to a considerable increase in the item "taxes and depreciation." The gross revenue for the six months amounted to $5,605, 501, a gain of 4.3 per cent over last year. The operating expenses, however, increased 10.7 per cent over last year, and taxes and depreciation increased $84,903. At the present time a joint committee of both houses of the St. Louis Municipal Council is investigating the affairs of the Railways company with a view to determining whether its earnings are proportionate to the operating expenses. The Public Service Commission of Missouri is formally appraising the property to determine whether it is earning profits on watered capitalization.

**Interborough Rapid Transit Company.**—The report of the Interborough Rapid Transit Company for the fiscal year which ended June 30 established a new record for gross income and showed an increase over 1909 of $2,463,253, or about 8.5 per cent. The expenses increased only 2.4 per cent, and the advance in net was about 12 per cent. The total receipts for the year was $28,987,648. The surplus at the end of the year was $2,932,147. The number of passengers carried during the year was 562,788,395, an increase of more than 8 per cent over the previous year. The Interborough company is adding to its equipment as rapidly as possible, and is lengthening all station platforms so as to be able to handle longer trains.

**Eastern Illinois Railway Company.**—A suburban electric railway, connecting the towns of Harvey, West Hammond, Dolton, Riverdale and Thornton, near Chicago, is projected. The company owning this road will be known as the Eastern Illinois Railway Company. It is said that Thomas E. Mitten, president of the Chicago City Railway Company, will be its president. A deed of trust to secure a bond issue of $5,000,000 has been placed on record. It is planned to have the tracks of the new company cross the tracks of steam railroads by means of steel bridges.

**East St. Louis Light & Power Company.**—Articles of incorporation have been recently filed for the East St Louis Light & Power Company of East St. Louis, Ill., with an authorized capital stock of $1,000,000. The new company is a consolidation of the old Consumers' Light, Heat & Power Company and its subsidiary, the Citizens' Electric Light Company, with the Southwestern Light & Power Company. L. C. Haynes, vice-president and general manager of the East St. Louis & Suburban Railway Company, will probably be the president of the new company.

**Newburg (N. Y.) Light, Heat & Power Company.**—The Public Service Commission of the Second District of New York has authorized the Newburg Light, Heat & Power Company to issue $70,500 first mortgage bonds the proceeds of which are to be used for the construction of a high-tension transmission line from Forest Glen to Montgomery, a distance of 15 miles, and distributing systems in the towns and villages along the route for which the company holds franchises.

**Kings County Electric Light & Power Company.**—In the first half of the calendar year the Kings County Electric Light & Power Company earned $499,250 over and above expenses and fixed charges, which is equivalent to almost 5 per cent on the $10,000,000 capital stock. This compares with an available surplus of $440,190 earned in a similar period last year. The business of the company is continuously growing, not only in electric lighting but also in gas.

**United Railways & Electric Company.**—It is stated that the United Railways & Electric Company of Baltimore is now practically free from floating debt, the last of it having been paid on the first of the present month. It is also given out that the company has on hand a cash balance of almost $600,000. At the beginning of the current year the floating debt amounted to $375,000.

**Sterling-Moline (Ill.) Traction Company.**—The Sterling-Moline Traction Company has been incorporated under the laws of the State of Illinois to construct an electric railway from Sterling, in Whiteside County, Ill., through the counties of Lee and Bureau to Princeton, Ill. The principal office will be in Sterling, and the capital stock of the company is $100,000.

**Chicago Railway Receivers.**—David R. Forgan and John M. Roach have been appointed receivers of the North Side Street Railways and the Chicago & Jefferson Urban Transit Company, at Chicago, by Judge Grosscup. This action practically places all of the underlying lines of the Consolidated Traction Company in the hands of receivers.

### DIVIDENDS.

Boston Elevated Railway Company, semi-annual, 3 per cent, payable Aug. 15.

Commonwealth Power, Railway & Light Company, preferred, quarterly, 1½ per cent, payable Aug. 1.

Guanajuato Power & Electric Company, preferred, 2 3/10 per cent, payable Aug. 1.

Kellogg Switchboard & Supply Company, quarterly, 3 per cent, payable Aug. 2.

Metropolitan West Side Elevated Railway Company, Chicago, quarterly, preferred ¾ per cent, payable Sept. 6.

Marconi Wireless Company, Ltd., initial 7 per cent, payable Aug. 1.

New Hampshire Electric Railways Company, Haverhill, Mass., preferred 4 per cent, payable July 30.

North American Company, quarterly 1¼ per cent, payable Sept. 15.

North Shore Electric Company, Chicago, quarterly, 1 per cent, payable Aug. 1.

Sierra Pacific Electric Company, preferred, quarterly, 1½ per cent, payable Aug. 1.

### REPORTS OF EARNINGS.

| | Gross earnings. | Expenses. | Net earnings. | Charges. | Surplus. |
|---|---|---|---|---|---|
| Associated Bell Telephone Companies: | | | | | |
| First half 1910 | $80,634,614 | $56,357,833 | $24,276,781 | $5,556,333 | $18,720,448 |
| First half 1909 | 72,112,092 | 49,383,170 | 22,728,922 | 5,584,905 | 17,144,017 |
| Aurora, Elgin & Chicago Railroad Company: | | | | | |
| June, 1910 | 151,851 | ..... | 75,057 | ..... | 40,590 |
| June, 1909 | 142,568 | ..... | 71,236 | ..... | 42,254 |
| Detroit United Railway Company: | | | | | |
| June, 1910 | 831,472 | 512,996 | 318,476 | 168,530 | 162,382 |
| June, 1909 | 698,485 | 423,826 | 274,659 | 156,997 | 129,823 |
| East St. Louis & Suburban Railway Company: | | | | | |
| June, 1910 | 200,553 | ..... | 87,678 | 50,121 | 37,557 |
| June, 1909 | 164,887 | ..... | 71,283 | 49,522 | 21,761 |
| Fonda, Johnstown & Gloversville (N. Y.) Railroad Company: | | | | | |
| June, 1910 | 79,291 | 43,607 | 35,684 | ..... | ..... |
| June, 1909 | 69,715 | 63,666 | 34,049 | ..... | ..... |
| Interborough Rapid Transit Company: | | | | | |
| Year ended June 30, 1910 | 28,987,648 | 11,013,143 | 17,974,505 | 1,750,422 | 16,635,107 |
| Year ended June 30, 1909 | 26,524,394 | 10,747,443 | 15,776,951 | 1,799,807 | 14,978,919 |
| Lake Shore Electric Railway Company: | | | | | |
| June, 1910 | 103,533 | 52,244 | 51,289 | 34,751 | 16,537 |
| June, 1909 | 95,825 | 48,784 | 47,041 | 34,479 | 12,562 |
| Massachusetts Electric Companies: | | | | | |
| Quarter ended June 30, 1910 | 2,130,957 | 1,340,169 | 790,788 | 418,237 | 372,551 |
| Quarter ended June 30, 1909 | 2,040,117 | 1,322,978 | 717,199 | 458,477 | 258,721 |
| Nashville Railway & Light Company: | | | | | |
| June, 1910 | 157,426 | 91,576 | 65,851 | 48,769 | 17,082 |
| June, 1909 | 144,461 | 81,946 | 62,515 | 48,204 | 14,310 |
| Northern Ohio Traction & Light Company: | | | | | |
| June, 1910 | 221,673 | 123,124 | 98,548 | 43,374 | 55,173 |
| June, 1909 | 208,203 | 107,975 | 90,227 | 42,504 | 45,982 |
| Twin City Rapid Transit Company: | | | | | |
| June, 1910 | 650,605 | 301,677 | 348,927 | 140,112 | 208,815 |
| June, 1909 | 593,101 | 260,881 | 332,220 | 140,251 | 191,969 |
| Western United Gas & Electric Company: | | | | | |
| Four months ended April 30, 1910 | 217,988 | 109,305 | 108,693 | 39,393 | 68,700 |
| Four months ended April 30, 1909 | 195,615 | 97,997 | 97,617 | 41,272 | 56,345 |

# General News

## Construction News.

*Arranged alphabetically by States.*

BIRMINGHAM, ALA.—The Sloss-Sheffield Steel & Iron Company is installing an electric power plant at its mines in Sloss at a cost of about $40,000. The plant will furnish electricity to operate the large pumps and machinery in the mines and for lighting the mines. Contracts for machinery and equipment have been placed with the Allis-Chalmers Company, of Milwaukee, Wis.

HARTSELLS, ALA.—The city has postponed the date for holding the election to vote on the proposition to issue $28,000 in bonds for the construction of an electric light plant and water-works system from Aug. 8 to Aug. 22. Xavier A. Kramer, of Magnolia, Miss., is consulting engineer.

ENGLAND, ARK.—The Richwood Gin Company is reported to be contemplating the installation of an electric light plant.

GRANNIS, ARK.—It is reported that a project is on foot to organize a company to establish an electric light plant in Grannis. John P. Logan, A. Coyle and others are interested in the enterprise.

OZARK, ARK.—We are informed that the Ozark Electric Light & Power Company is contemplating changing its system to two-phase, 60-cycle soon, and will also install producer gas units. R. B. Bryant is manager.

BERKELEY, CAL.—The business men on University Avenue, from Oxford Street to Shattuck Avenue, have submitted a proposition to the City Council offering to pay for the erection of electroliers in that section, provided the city will furnish electricity for same.

BERKELEY, CAL.—The City Council has granted the Great Western Power Company a franchise for a term of 50 years to supply electricity for lamps, heat and motors in Berkeley, under the terms of which the company agrees to pay the city 2 per cent of its gross receipts during the first 10 years; for the third 10 years 4 per cent, and 5 per cent for the remainder of the life of the franchise.

CHICO, CAL.—The new electric power plant of the Diamond Match Company has been completed and is in operation. The entire works of the company will be operated by electricity with exception of the steam hammers, which heretofore have been run by steam power. The steam plant will be kept intact for use in emergencies. About 1000 hp will be required to operate the plant.

COLTON, CAL.—Plans are being considered for extending the ornamental street lighting system in Colton. Earl M. Crilly is manager of the municipal electric light plant.

HANFORD, CAL.—The Hanford & Summit Lake Railway Company has awarded a contract for the construction of its proposed electric railway to extend from Hanford to Summit Lake, via Hanford, Grangeville and Hardwick, a distance of 18 miles, to Libby & Heins, of Santa Cruz. J. B. Rogers, of Hanford, Cal., is chief engineer.

LOS ANGELES, CAL.—It is reported that extensive improvements are contemplated by the Huntington interests in the Agricultural Park district. A contract has been awarded to the Alta Planing Mill Company for the construction of a brick substation to generate and transform electricity for both the Grand Avenue and Redondo Railway systems.

LOS ANGELES, CAL.—The Acton Rock Company, which is increasing the capacity of its crushing plant, has placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for the following equipment: One No. 12, two No. 5 and one No. 2, style "K," Gates breakers; one 48-in. x 14-ft. and one 48-in. x 24-ft. Gates revolving screens, conveyors and 10 induction motors, varying in size from 3 hp to 175 hp.

MARTINEZ, CAL.—It is reported that the Contra Costa Electric Light & Power Company has been absorbed by the Pacific Gas & Electric Company, of San Francisco, Cal.

POINT RICHMOND, CAL.—The Richmond Light & Power Company and the Pacific Gas & Electric Company have come to an agreement in regard to rates to be charged for gas and electrical service. Owing to the dispute over rates the Pacific Gas & Electric Company discontinued work on construction of its new plant, which will now be rushed to completion.

REDDING, CAL.—The Sacramento Valley Power Company is extending its transmission lines in several directions from Corning for the purpose of furnishing electricity in that vicinity. A transmission line is also being erected to Squaw Creek Ferry to furnish electrical service to residents along the river.

SAN FRANCISCO, CAL.—Announcement has been made that the Pacific Gas & Electric Company has purchased the lighting and water plants located in Wheatland, Lincoln, Davis, Roseville, Cordelia, Elmira, Whittier, Dixon and Benicia.

SAN LEANDRO, CAL.—The power house and engine house on the estate of I. W. Hellman, Jr., in San Leandro, was destroyed by fire recently, causing a loss of about $50,000. The plant furnished electricity for lighting the house and grounds of the estate and for pumping water. Work will commence on reconstruction of the power plant immediately.

COLORADO SPRINGS, COL.—The Grand Junction & Grand River Valley Railroad Company, which has recently completed an electric railway between Grand Junction and Fruita, is reported to be planning to extend the railway the entire length of the Grand River Valley.

COLORADO SPRINGS, COL.—At a special meeting of the stockholders of the Colorado Springs Light, Heat & Power Company held recently bonds to the amount of $3,500,000 were authorized to take over the bonded indebtedness of the three corporations recently consolidated. The companies taken over by the above-named company were the Colorado Springs Electric Company, the Pike's Peak Hydro Electric Company and the Citizens Heat & Power Company.

NEW MILFORD, CONN.—Extensive improvements are being made to the plant of the New Milford Power Company, a subsidiary of the New York, New Haven & Hartford Railroad Company, which will involve an expenditure of about $250,000 and include the construction of a large reservoir and a core dam 700 ft. long.

SOUTH NORWALK, CONN.—Contract has been awarded by the South Norwalk Electric Light Commissioners for the construction of the new extension to the municipal electric light plant to John Driscoll, for $2,828. The new building will be 32 x 23 ft. and will be equipped with a Deisel engine, a Fort Wayne generator and an air compressor manufactured by the Norwalk Iron Works, for which contracts have been placed. The cost of the entire work is estimated at $30,000.

WILMINGTON, DEL.—The E. I. du Pont de Nemours Powder Company is extending the use of electrical power in all of its plants. The company has recently placed orders with the Allis-Chalmers Company, of Milwaukee, Wis., for 11 type "K," direct-current motors for its plant at Wilpen, Minn., and for 15 induction motors for the works at Hillside Junction, Pa.

WASHINGTON, D. C.—It is reported that the power plant of the Great Falls & Old Dominion Railway will be enlarged, work on which has already commenced. The cost of the work is estimated at about $50,000.

WASHINGTON, D. C.—The Capital Traction Company, of Washington, D. C., is making preparations for extensive improvements to its main power plant. It is proposed to rebuild the station and increase the output by 6000 kw, the cost of which is estimated at about $250,000.

WASHINGTON, D. C.—Bids will be received at the Department of the Interior, Washington, D. C., until Aug. 8 for the installation of a vacuum heating system for the pension office building, Washington, D. C., in accordance with plans and specifications, copies of which may be obtained upon application to the chief clerk of the department. Frank Pierce is acting secretary.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until Aug. 6 under proposal 472 for furnishing 70 gun outlet boxes, 85 boxes for time interval bells, 100 hydrometers, type E; 100 hydrometers, type H; 50 bolt connectors and 20 double plugs for cut-off jack sets. Captain A. S. Cowan is disbursing officer.

WASHINGTON, D. C.—The Washington, Berwind & Laurel Railroad, which is owned by the Washington, Baltimore & Annapolis Electric Railway Company, recently placed in the hands of receivers, will be sold at a receiver's sale Sept. 1 at Laurel, Md. The railway extends from Laurel, Md., to Washington, D. C., a distance of 15 miles. Charles F. Gladfelter, secretary and treasurer of the Washington, Baltimore & Annapolis Railway Company, is receiver.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 16 for furnishing to the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 2780, 60 salvo firing buzzers; Schedule 2768, electrical wires and cables, to be delivered at the various navy yards and naval stations. Washington, D. C., Schedule 2773, electrical wires and cables. Brooklyn, N. Y., Schedule 2770, 100 single-phase induction fans; Schedule 2780, 1350 pounds cotton insulating tape. Boston, Mass., Schedule 2780, 300 dry cells, reserve type, 1000 pounds cotton and rubber insulating tape; Schedule 2766, to be delivered to the various navy yards and naval stations, miscellaneous telephone supplies and accessories.

APALACHICOLA, FLA.—The Apalachicola Electric Light & Telephone Company is planning to replace the present arc lamp street lighting system with tungsten lamps at the expiration of its present street lighting contract. The contract expires in the fall. J. F. C. Griggs and R. G. Porter are owners of the plant.

MULBERRY, FLA.—The Florida Mining Company has recently purchased from the Allis-Chalmers Company, of Milwaukee, Wis., a 115-kw, 2300-volt, three-phase, 60-cycle, 900 r.p.m. generator, belted type, and four 250-kva, oil-filled, self-cooled transformers.

ATLANTA, GA.—Bids will be received at the office of the superintendent of prisons, Department of Justice, Washington, D. C., until Aug. 17 for furnishing and delivering at the United States penitentiary at Atlanta, Ga., conduit, outlet boxes, etc., for electric light, telephone and

clock outlets for the hospital building, in accordance with specifications, copies of which, with other information, can be obtained on application to the above office. R. V. Ladow is superintendent of prisons.

EASLEY, GA.—The contract for installing electrical equipment for lamps and motors in the Alice Cotton Mills, of Easley, has been awarded to Witman & Mountford, of Macon, Ga.

HAMPTON, GA.—Preparations are being made by the Hampton Cotton Mills to equip its plant for electrical operation, replacing steam power. Contract for electricity for operating the mills, it is said, has been placed.

LAFAYETTE, GA.—The City Council has awarded the contract for the construction of the municipal electric light plant and water-works system to J. B. McCrary & Company, of Atlanta, Ga. Work will begin immediately and is to be completed by November, 1910.

BOISE, IDAHO.—James Lynch & Company have secured the contract for the construction of the power plant and dam of the Snake River Irrigation Company in connection with the Castle Butte project on the Snake River, located about 38 miles south of Boise. The contract provides that the work shall be completed within five months. The project involves the irrigation of about 17,000 acres.

BATAVIA, ILL.—The contract for the installation of two 110-hp boilers in the municipal electric light plant has been awarded to Freeman & Son, of Racine, Wis., for $6,300.

CHICAGO, ILL.—The City Council has granted the Chicago City Railway Company a franchise to build the Riverdale extension from Gardner's Park to the city limits at 138th Street. The company was also granted a franchise for an extension of the Stony Island Avenue line north to Fifty-sixth Street.

EAST ST. LOUIS, ILL.—Arrangements are being made for the reorganization of the Consumers' Light, Heat & Power Company, which has recently filed articles of incorporation under the name of the Southwestern Light & Power Company. It is proposed to consolidate the old Citizens' Electric Light Company, the Consumers' Light, Heat & Power Company with the Southwestern Light & Power Company under the name of the East St. Louis Light & Power Company. The company will be capitalized at $1,000,000. L. C. Haynes, vice-president and general manager of the East St. Louis & Suburban Railway Company, and T. W. Gregory, assistant secretary and treasurer, of the same company will be the principal officers of the new company.

EVANSTON, ILL.—Contracts have been placed by the North Shore Electric Company with the Allis-Chalmers Company, of Milwaukee, Wis., for additional transformers for the new extension which the company is now building. The order calls for 2300-5300-volt, 60-cycle, oil-filled, self-cooled transformers with a rating of 172 kva.

FULTON, ILL.—The contract for the erection of the North-Western power house in the Fulton terminal yards has been awarded to J. J. Jobst, of Peoria, Ill. The building will be 100 ft. x 110 ft. and will be equipped with improved machinery. Steam will be generated by a battery of five 150-hp boilers.

MARSEILLES, ILL.—It is reported that the McKinley system will make extensive improvements and extensions to the Desplaines River power plant, located in Marseilles, recently purchased from W. D. Boyce, which will involve an expenditure of about $200,000. It is estimated that about 4000 hp will be developed.

MORRIS, ILL.—The question of installing electrical pumping machinery in the pumping station is reported to be under consideration.

VERSAILLES, ILL.—The D. H. Allen property in Versailles has been purchased by J. G. Elliott, who proposes to erect an electric light and power plant on the site.

BEDFORD, IND.—The Bedford Power Company, which is planning an extensive hydroelectric development on the east branch of the White River, at Williams, Ind., has recently placed a contract with the Allis-Chalmers Company, of Milwaukee, Wis., for two 750-kw steam turbo-generators, which will serve as auxiliaries for emergency use. The Allis-Chalmers has also recently received an order for the equipment of the initial installation of the hydraulic and electrical apparatus, including two 1050-hp, triplex vertical turbines operating under a head of 17 ft., to be direct connected to a 1000-kva (70 per cent power factor), 2300-volt, 60-cycle, three-phase alternators. Plans are also being made for three larger units to be put in service later.

INDIANAPOLIS, IND.—The Board of Public Works has instructed the Indianapolis Light & Heat Company to install 193 additional lamps, at $74 each per year, which will add $13,232 annually to the cost of the street lighting system.

LINDEN, IND.—The plant and holdings of the Linden Co-operative Company has been purchased by Theodore H. Ristine, H. H. Ristine and J. K. Johnson, directors of the Home Telephone Company, of Crawfordsville. The new owners will make improvements to the property, including the erection of a new telephone exchange and extension of the lines into adjacent territory.

LOWELL, IND.—The capital stock of the Lowell Telephone Company has been increased to $25,000, the proceeds to be used for improvements to the system and service. Clifford O. Hill is secretary.

MIDDLETOWN, IND.—At an election held recently the citizens voted in favor of the proposition to establish a municipal electric light plant. The cost of the plant is estimated at $28,000. F. A. Weisehart is town clerk.

MILFORD, IND.—The County Commissioners have granted a franchise to Omar Neff, of Milford, Ind., to construct an interurban railway from Bremen to Mishawka, via Woodland.

SULLIVAN, IND.—The City Council has passed an ordinance providing for the installation of a new electric fire-alarm system.

DES MOINES, IA.—Plans are being prepared by the Des Moines Electric Company for the construction of a new substation on Tenth Street, near Grand. The building will be 33 ft. x 132 ft. and will cost about $25,000. The company is installing conduits to put its wires underground in the business section of the city.

DEXTER, IA.—The construction of an electric light plant and water-works system in Dexter is under consideration. E. J. Frum is city clerk.

MANCHESTER, IA.—Contracts have been awarded by the Manchester Light, Heat & Power Company for a 150-hp boiler and two 15-kw transformers.

MASON CITY, IA.—The Mason City & Clear Lake Railway Company has been granted a franchise by the County Commissioners of Gordo County to construct an electric railway along the highway extending north from Mason City.

MASON CITY, IA.—President Loring, of the Fort Dodge, Des Moines & Southern Railroad Company, has submitted a proposition to the patrons of the railway relative to equipping the line for electrical operation between the towns of Fort Dodge, Junction and Blackwell City. He asks for a bonus of $5,000 if the work is completed by November. Of this amount the citizens of Calhoun County are to pay $3,500 and of Webster County $1,500.

DAYTON, KY.—Proposals will be received at the office of William C. Martin, city clerk, for a franchise to erect and operate a telephone system in the City of Dayton for a term of 20 years.

LEAVENWORTH, KAN.—Sealed proposals will be received at the office of superintendent of prisons, Department of Justice, Washington, D. C., until Aug. 19 for furnishing and delivering at the United States penitentiary at Fort Leavenworth, Kan., conduit, outlet boxes, etc., for electric light, telephone and clock outlets for the hospital building, according to specifications, copies of which, together with other information, may be had upon application to the above office. R. V. Ladow is superintendent of prisons.

MANHATTAN, KAN.—Plans are being considered by the Manhattan City & Interurban Railway Company for extending its railway to Junction City. Surveys have been made at the Fort Riley Reservation in order to make application to the War Department for right of way across the reservation.

McPHERSON, KAN.—Active steps have been taken to reestablish the electric light plant and water-works system. Arrangements have been made to install the new generators in mills until permanent buildings are erected. Both the light and water plants are owned and operated by the city.

GLASGOW, KY.—The Louisville, Lincoln Farm & Mammoth Cave Traction Company, it is reported, will award contracts about Sept. 1 for construction of its proposed railway to connect Louisville and Mammoth Cave, a distance of 60 miles. A hydroelectric power plant will be erected on Green River. J. M. Richardson is president.

CROWLEY, LA.—The City of Crowley is reported to be considering the installation of a 250-hp water-tube boiler, an engine-driven generator with a rating of 175 kw in the municipal electric light plant, bids for which will soon be asked.

FOREST, LA.—A franchise has been granted to H. H. Moorland to construct telephone lines on the highways of West Carroll Parish.

PRESQUE ISLE, MAINE.—The Aroostook Electric Railway Company is reported to be contemplating extending its railway through the towns of Woodland and Perham to Madawaska Lake, a distance of 19 miles.

BALTIMORE, MD.—The Board of Awards has awarded the contract for street lighting to the Consolidated Gas, Electric Light & Power Company for the term of one year. In the past the contract has been given for a period of five years, but owing to the excessive charge of electricity Superintendent of Lamps and Lighting McCuen recommended the one-year contract. Superintendent McCuen will soon file a report on a municipal lighting plant in which he will show that the city can generate energy much cheaper than it can purchase it from the Consolidated company.

BALTIMORE, MD.—Proposals will be received by the Board of Awards until Aug. 17 for furnishing material and constructing power house for the Bayview Asylum as follows: First—Furnishing materials and erection of power house complete. Second—For furnishing and installing engines, generators, switchboard and electric wiring. Third—For boilers, piping in power house and grounds. Fourth—For constructing water supply system, including water storage tank, pumps, etc., to be furnished for the Bayview Hospital, for the use of the Board of City Charities. Plans can be seen at the office of Edward D. Preston, inspector of buildings. J. Barry McHool is president of Board of Awards.

HAGERSTOWN, MD.—The stockholders of the Hagerstown Railway Company, which operates a street railway system in and around Hagerstown, and the Frederick Railway Company, which operates an electric railway in Frederick and surrounding territory, have decided to consolidate and form a new company for the purpose of supplying power

for both systems. When the new plant is completed the new company proposes to supply electricity for lamps and motors in Hagerstown and Frederick. It is understood that some of the steam lines will be equipped for electrical operation. The present steam railway between Frederick and Thurmont, it is said, will be equipped to be operated by electricity, and later it is proposed to extend the line to Emmitsburg.

THURMONT, MD.—The Thurmont electric light plant, built as a private enterprise by citizens of Thurmont, has been taken over by the town officials at a cost of $20,000. The plant has an output of 150 hp and is driven by water power. William J. Freeze is Mayor.

CAMBRIDGE, MASS.—The plant of the Cambridge Light & Power Company was offered for sale July 19 by William H. Medford, receiver, and was withdrawn after being bid up to $16,000 by Emerson C. Harrington, representing the Assets Realization Company, of New York, N. Y. The plant was built early in 1909 under a franchise granted William H. Medford and John H. Burgess, Jr., in 1907. It is said that failure to secure the contract for lighting the town was the cause of the failure of the company.

DALTON, MASS.—The Bryon Weston Company has installed a 200-hp motor to operate its plant at the Center. The motor will take the place of the steam plant.

EGREMONT, MASS.—Application has been made to the Council by the Berkshire Street Railway Company for a franchise to construct and operate an electric railway in Egremont. The company will also ask for a franchise in Great Barrington. It is proposed to extend the railway from the terminus at Great Barrington to South Egremont, a distance of about 4 miles.

FOXBORO, MASS.—The Foxboro Electric Company is contemplating the purchase of the power plant of the Standard Gauge Manufacturing Company, of Foxboro, which it proposes to equip for a central-power station. Owing to establishing a 24-hour service recently, the company is obliged to increase the output of its power plant. The company has applied to the State Board of Gas and Electric Light Commissioners for permission to issue additional capital stock to the amount of $43,500, the proceeds to be used to purchase the plant of the Standard Gauge Company.

FRANKLIN, MASS.—Preparations are being made by the Union Electric Light Company to change over the present street lighting system as voted by the town last March. Under the present plans it is proposed to change from the present arc-lamp system to part arc and part incandescent lamps. Since the demonstration by the company of the five-cluster and three-cluster incandescent lamps the sentiment seems to be in favor of an entire incandescent system, and it is expected that the Selectmen will call a special town meeting to see if the voters desire to rescind the vote of last March and adopt the incandescent system throughout the town.

MILLBURY, MASS.—Announcement has been made of the plan for the consolidation of the Millbury Electric Company with the Uxbridge & Northbridge Electric Company, of Uxbridge, Mass., the Grafton Electric Company, of Grafton, Mass., the Upton Electric Company, of Upton, Mass., and the Douglas Electric Company, of Douglas, Mass., under the name of the Worcester Suburban Electric Co. The consolidated company will be capitalized at $242,000. The companies have already filed a petition with the State Gas and Electric Light Commission for permission to consolidate.

NEW LENOX, MASS.—At the last special town meeting $500 was appropriated for street lighting in New Lenox. Arrangements are now being made with the Pittsfield Electric Light Company to extend its service to this town.

NEWTON, MASS.—Plans have been decided upon for a new lighting system to be installed on Newton Boulevard from Lake Street to Weston Bridge. The new system will be installed by the Edison Electric Illuminating Company, consisting of 73 magnetite lamps of 800 cp each, to be placed on posts 24 ft. high. The new lamps will cost $42 each for installation and one and one-third cents per kw-hour for electricity used. The old style lamp, of which there were 59, cost $36 each per year and one and one-half cents for energy used.

NORTH ABINGTON, MASS.—The State Board of Gas and Electric Light Commissioners has authorized the Electric Light & Power Company of Abington & Rockland to issue 540 shares of capital stock at $150 each, the proceeds to be used for the purchase of additional equipment for its plant and for payment of outstanding indebtedness.

REVERE, MASS.—The State Board of Gas and Electric Light Commissioners has granted the Suburban Gas & Electric Company, of Revere, Mass., permission to issue 1190 shares of capital stock at $140 per share, the proceeds to be used for the cancellation of indebtedness and power-plant extension charges.

SPRINGFIELD, MASS.—The City Council has granted the Springfield Street Railway Company a franchise to build an extension of the St. James Avenue line to connect with Chicopee.

WESTFIELD, MASS.—The Western Massachusetts Street Railway Company is making extensive additions to its power plant on Emery Street, which will double the output. New equipment, including boiler, generator, condenser and engine will be installed.

WORCESTER, MASS.—Owing to low water, caused by drouth, the Connecticut River Transmission Company is unable to supply the full amount of electricity which it has contracted for to manufacturers in Worcester and Worcester County. The company has discontinued the service to the American Steel & Wire Company's plant on Grove Street, where it has a contract to supply 1600 kw; it is continuing the service to the south works of the American Steel & Wire Company, which requires 1500 kw. The service at the Lancaster Mills, at Clinton, has been discontinued and other manufacturing plants have had to resume the use of steam power.

WORCESTER, MASS.—The Worcester Electric Light Company has placed contracts for furnishing electricity for motors for several manufacturing plants in Worcester, including the Worcester Slipper Company, which has a contract for 80 hp; William M. Brown, 50 hp; E. T. Smith & Company, 50 hp; the Worcester Brewing Corporation is installing machinery which will require 300 hp eventually; William H. Leland & Company, 100 hp; Baldwin Chain & Manufacturing Company, 350 hp, and Coes Wrench Company, 200 hp. The Worcester company is installing machinery at Crompton & Knowles loom works to utilize 500 hp, which will be equipped for electrical operation by Aug. 4; the Wyman & Gordon Machine Company will have its plant equipped to be operated by electricity in the near future and will require 300 hp. All the companies mentioned are replacing steam power with electricity, the steam plants being held for auxiliary and emergency purposes.

MINNEAPOLIS, MINN.—Plans are being considered for the erection of a union terminal station for all local and interurban electric railways operating in Minneapolis.

MINNEAPOLIS, MINN.—The Red Lake Power Company has filed an amendment to its charter increasing its capital stock from $150,000 to $1,000,000. The company proposes to furnish electricity in Red Lake Falls, Minn.

MINNEAPOLIS, MINN.—Extensive improvements to the waterworks system have been recommended by City Engineer Andrew Rinker, which includes the construction of four miles of distributing water mains and an additional pump at the Camden Place pumping station. The city engineer favors the installation af an electrically driven centrifugal pump.

MINNEAPOLIS, MINN.—Owing to low water in the Mississippi River the Twin City Rapid Transit Company is unable to generate sufficient electricity at its power house to operate its system. The transit company has made arrangements with the Minneapolis General Electric Company for additional service from its steam plant in Minneapolis. W. J. Hield is vice-president and general manager of the Twin City Rapid Transit Company.

MERIDIAN, MISS.—The Meridian Light & Railway Company has filed amendments to its charter, increasing its capital stock to $5,000,000.

CARTHAGE, MO.—It is reported that a new quarry is being developed by Millard Bryan, near Carthage, Mo. The quarry, it is said, is being equipped for electrical operation, electricity for which will be supplied by the Empire District Electric Company, when its new transmission line is completed. Other quarries in this district are also contemplating using electricity for operating machinery.

SPRINGFIELD, MO.—W. H. Johnson, of Springfield, Mo., is interested in a project to construct a large dam across the White River at Hollister, 40 miles from this city, the power to be utilized to generate electricity for transmission to Springfield. It is proposed to have the City of Springfield apply to Congress for permission to erect a dam across the river at Hollister (under the present conservation laws a private corporation could not secure a franchise to build the dam), where it is estimated that 150,000 hp could be developed, and build a transmission line, for $750,000. Of this amount $225,000 is allowed for the construction of the dam, $225,000 for power plant, $120,000 for transmission line and $150,000 for incidentals. Should the proposit on be adopted industrial bonds would be issued to build the plant.

WEBB CITY, MO.—The Southwest Missouri Electric Railroad Company is planning to build a new substation in the near future. The equipment will include a 500-kw, 25-cycle rotary transformer and switchboard. A. H. Rogers, of Webb City, Mo., is general manager.

RENO, NEV.—Stone & Webster, of Boston, Mass., have assumed the management of a new company, known as the Sierra-Pacific Electric Company, which owns all the capital stock of the companies which control the entire electrical business in Reno, Sparks, Virginia City, Carson City and Silver City, Nev., and in the surrounding important mining and irrigation districts of Western Nevada. These companies also own the entire gas business in Reno, Sparks and Carson City and supply water for domestic purposes in Reno and Sparks. They also own four hydroelectric power plants on the Truckee River, having a combined output of 7300 hp. Owing to the increasing demands for electricity, it is proposed to erect a new hydroelectric power plant on Truckee River to develop 9000 hp.

CONCORD, N. H.—A new electric power house is being erected at the Franklin Needle Works. Two turbines, of 60 hp and 30 hp, respectively, are being installed.

MANCHESTER, N. H.—Work has commenced on the construction of the large machine shop to be erected by the Leighton Machine Company. A power plant and coal pocket will also be built in connection with the shop.

NASHUA, N. H.—Plans are being prepared by the White Mountain Freezer Company for the installation of a new power plant, which will be located near the Acton track. The new engine will have a rating of 200 hp. A generator with sufficient output to light the works and for motors will be installed.

MENDHAM, N. J.—The Bernards Water Company, of Bernardsville, N. J., has applied to the Borough Council for a franchise to furnish electricity in this borough.

NEWARK, N. J.—A contract has been placed by the Nairn Linoleum Company with the Allis-Chalmers Company, of Milwaukee, Wis., for a 100-hp, 550-volt, three-phase, 60-cycle, squirrel cage induction motor.

BROOKLYN, N. Y.—The Edison Electric Illuminating Company of Brooklyn is planning to erect a new substation at 864 Madison Street. The building will be 25 ft. x 100 ft., two stories high and will cost about $20,000.

BROOKLYN, N. Y.—The Public Service Commission has granted the Coney Island & Brooklyn Railroad Company permission to issue bonds to the amount of $489,539, the proceeds to be used for improvements, most of which will be used for removal of the tracks in Coney Island Avenue from the side to the middle of the thoroughfare.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until Aug. 10 for installation of electric equipment in addition to and alterations to present equipment in Public School 19, located on Keap Street, between South Second and South Third streets, Borough of Brooklyn, N. Y.

BUFFALO, N. Y.—Sealed proposals will be received at the office of Alonzo G. Hinckley, clerk Board of Supervisors, until Aug. 9 for the construction of a power plant at the Erie County Penitentiary, in accordance with plans and specifications on file at Room 36, City and County Hall, and at the office of the county engineer, 575 Ellicott Square, Buffalo, N. Y.

BUFFALO, N. Y.—The supervisors' penitentiary committee has decided to reject all bids received on the second advertising for the installation of a power plant at the penitentiary and readvertise for bids. This action was taken after receiving a letter from John W. Danforth Company offering to do the work for $9,918 less than the lowest bid received, which was submitted by C. H. Everitt. The amount of his bid was $69,918.

BUFFALO, N. Y.—The Electrolytic Products Company, of Buffalo, N. Y., is reported to have purchased a factory site at Elmwood and Hertel avenues on which it proposes to erect a plant for the manufacture of radiators for automobiles. Copper radiators will be made by an electrical deposit process under patents which the company owns. Plans are now being prepared for the plant. Frank E. Abbott, D. S. Morgan Building, Buffalo, N. Y., is secretary of the company.

BUFFALO, N. Y.—The City Council has adopted resolutions authorizing Francis G. Wood, commissioner of public works, to advertise for bids for machinery and equipment for vocational school in district No. 20, consisting of 25 direct-connected motor head lathes, Oliver No. 53 A, or equal; one direct-connected motor head lathe, Oliver No. 53 E, or equal; one 10-hp motor-generator; one universal saw, with motor; one band saw, with motor; one grinder; one jointer; 26 Sheldon woodworking benches, Sioux City model, or equal.

FRANKLINVILLE, N. Y.—It is reported that plans have been prepared by H. B. Sweet, consulting engineer, of Utica, N. Y., for the installation of a new lighting system and rebuilding the distributing system of the Empire Electric Company, of Franklinville, N. Y. The company, it is said, will be in the market for cedar poles, weather-proof copper wire, cross-arms, line supplies; also transformer, switchboard and tungsten lamps for street lighting system.

NEWBURGH, N. Y.—The Public Service Commission, Second District, has authorized the Newburgh Light, Heat & Power Company to purchase an electric light plant owned and operated by Marion Borden Halliday in Shanangunk. The company has also been granted permission by the commission to operate franchises granted by the Town Board and Highway Commissioners of the Town of Montgomery and the Town of Shawangunk for the construction of an electric lighting system in those places. The commission has also granted the company permission to erect a high-tension transmission line carrying 33,000 volts from Forest Glen in the Town of Gardiner to and through the Town of Shawangunk to connect with the distribution lines in that village and to the Village of Walden, thence to Montgomery, and such other distribution lines as will enable the company to distribute electricity in the territory where it has franchises. The Newburgh Light, Heat & Power Company has also been authorized to issue first mortgage bonds to the amount of $70,500, the proceeds to be used for the construction and equipment of a high-tension transmission line from Glen Forest to Montgomery, a distance of 15 miles and for distributing systems in the towns and villages in which it has franchises.

RIVERHEAD, N. Y.—The Riverhead Electric Light Company has been granted permission by the Public Service Commission, Second District, to exercise a franchise granted by the Town Board of Southampton to furnish electricity for lamps and motors in that town. The company has also been authorized to issue bonds to the amount of $7,300, the proceeds of $5,000 to be used for the construction and equipment of a transmission line from its station in Riverhead to the Village of West Hampton Beach, and the proceeds, $2,300, to be used for the purchase of generating machinery and switchboard.

ROCHESTER, N. Y.—A permit has been granted to the Mechanics' Institute for the construction of a power plant, the cost of which is estimated at $13,000.

ROCHESTER, N. Y.—The Monroe County Building Commission has awarded a contract to the Ridgway Dynamo & Engine Company, Ridgway, Pa., for the installation of an engine-driven generating set at the power house on South Avenue, Rochester, N. Y., for $2,175.

ROCKVILLE CENTRE, N. Y.—The New York Telephone Company has been granted permission by the Village Trustees to install conduits on the streets of the village for its telephone wires.

ROCKVILLE CENTRE, N. Y.—The Village Trustees have instructed the village clerk to ask for bids for the installation of a 1,000,000-gal. pump at the pumping station to be operated either by steam or electricity.

SILVER SPRINGS, N. Y.—At a special election held July 19 the citizens voted in favor of the proposition to issue $14,000 in bonds, the proceeds to be used for drilling wells and erecting a pumping station and $6,000 for the installation of an electric light plant.

WALTON, N. Y.—The Public Service Commission, Second District, has granted its approval of the transfer of the electrical plant and distributing system in Walton, owned by Clarence Mulkins, to Carlton A. Graves, for a consideration of $5,000.

WAPPINGER FALLS, N. Y.—After December, 1910, the municipal electric plant will be discontinued and electrical service will be furnished from the new hydroelectric power plant of the Garner Print Works and Bleachery, now under construction. When the new system is installed a 24-hour service will be established. The system will remain two-phase, 220-110-volt, 60-cycle. C. H. Fish, of Wappinger Falls, is superintendent.

CHARLOTTE, N. C.—The City Council has granted a franchise to Paul Chatham to construct an electric railway in Charlotte.

SALISBURY, N. C.—Preparations are being made for the construction of an addition to the weaving department of the Salisbury Mills, 74 ft. x 80 ft., which will be equipped with 80 looms. The machinery in the mills is driven by electric and steam power.

AKRON, OHIO.—The Northern Ohio Traction & Light Company has three sites under consideration for its proposed new power plant, Springville Lake, Cuyahoga Falls and a point near the Tuscarawas River, between New Philadelphia and Canal Dover. The Canton plant furnishes electricity for operating the Canton-New Philadelphia division, the Canton and Massillon city systems and also takes part of the load of the Canton-Akron division. The Midvale plant furnishes power for the Uhrichsville line. Charles Curry is general manager.

CINCINNATI, OHIO.—Sealed proposals will be received at the office of the clerk of the Board of Education, City Hall, Cincinnati, Ohio, until Aug. 15 for furnishing and installing complete electric lighting fixtures, etc., in the Woodward High School building, Cincinnati, Ohio, according to plans and specifications on file at the office of C. W. Handman, business manager, 511 West Court Street, Cincinnati, O.

CLEVELAND, OHIO.—Bids will be received by the Board of County Commissioners of Cuyahoga County at the office of the Cuyahoga County Building Commission, Garfield Building, Cleveland, Ohio, until Aug. 24 for furnishing electricity for lamps and motors and for steam heating for the new court house building for a period of 6, 8 and 10 years from Nov. 1, 1910, in accordance with specifications prepared by H. W. Woodward, of the Cleveland Engineering Company, which may be secured from the clerk of the board. John F. Goldenbogen is clerk.

CLEVELAND, OHIO.—Bids amounting to $376,000 for the proposed power plant for the new court house have been rejected by the Cuyahoga County Commissioners, as well as the bid of John Gill & Son for the building complete. Engineers are now at work on modified plans for a plant to cost about $175,000, on which bids may be called, although the electric companies will probably be asked to submit bids in the meantime. The Cleveland Electric Illuminating Company recently submitted a bid of 3¼ cents per kw-hour for furnishing electricity, which would mean a cost of about $22,000 per year. The commissioners state that they will build a plant of some kind rather than to pay the private companies an exorbitant price for the service.

FREMONT, OHIO.—A mechanic's lien has been filed in the district court in Fremont, Ohio, against the Fremont Power & Light Company, of Fremont, Ohio, by R. S. Fuertado, consulting engineer, 460 Monadnock Block, Chicago, Ill., to collect an account from the company to the amount of $9,000 for engineering work.

PORT CLINTON, OHIO—Preparations are being made by the Colonial Crayon Company for the installation of an electric plant to furnish electricity to operate its machinery. Orders have been placed by the company with the Allis-Chalmers Company, of Milwaukee, Wis., for a 50-kw generator, four induction motors and two lighting transformers.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company is offering its stockholders $100,000 in preferred stock, the proceeds to be used to complete its power plant. The total cost of the plant is estimated at $250,000. The company recently increased its capital stock from $1,000,000 to $2,000,000.

YOUNGSTOWN, OHIO.—The court house building commission of Mahoning County is considering the question of installing an electric light and power plant for the new court house and jail building.

BRIDGEPORT, OKLA.—It is reported that the installation of a municipal power and pumping plant is under consideration, plans for which have been prepared. The equipment will include a direct-acting triplex pump, driven by a gas or gasoline engine. It is understood that the machinery will be purchased the latter part of this month.

COLLINSVILLE, OKLA.—A company has been formed by J. H. Middleton, H. D. Barndollar and C. L. Goodale to build an electric power plant to supply electricity for lamps and motors in Collinsville. The equipment of the plant will consist of an Allis-Chalmers, 110-kw, 2300-volt, three-phase, 60-cycle generator and a 10-kw exciter.

GRANDFIELD, OKLA.—Application has been made to the City Council by E. E. Preston and J. E. Fitzpatrick for a franchise to establish an electric light plant in Grandfield. The cost of the plant is estimated at $10,000.

HOBART, OKLA.—Extensive improvements are contemplated to the water-works system, including the construction of a large dam, an eight-inch main to Big Elk Creek and the installation of an electric motor to pump water to settling basin.

OKLAHOMA CITY, OKLA.—Preparations are being made by the Oklahoma Gas & Electric Company for extensive improvements to its system, which will involve an expenditure of about $250,000 and will include the construction of a large building to be used for store house, the installation of additional boilers and machinery, which will increase the output of the plant by 3000 hp, and improvements to the distributing system. F. H. Tidman is manager.

ALBANY, ORE.—The City Council has granted the Albany Interurban Railway Company a franchise to construct and operate an electric railway over certain streets in the city. The proposed railway is to connect Albany, Sweet Home, Lebanon, Brownsville and Holley, a distance of 85 miles. P. A. Young is interested in the project.

KLAMATH FALLS, ORE.—Preparations are being made by the Pacific Telephone & Telegraph Company for extensive improvements to the local telephone system in Klamath Falls and adjacent territory, which will involve an expenditure of about $100,000, within the next six months. The company recently purchased the local system from H. V. Gates.

MARSHFIELD, ORE.—Plans are being considered by the business men for the installation of a new lighting system in the business districts in Marshfield. J. W. Bennett is interested in the project.

MARSHFIELD, ORE.—The Coos Bay Gas & Electric Company, of Marshfield, Ore., has commenced work on extensive improvements to be made to its systems in Marshfield and North Bend. It is proposed to entirely rebuild the power plant which is located between the two cities.

CARLISLE, PA.—Electricity for operating the Newville electric railway will be supplied from the power plant located at Mt. Holly Springs, which has been enlarged to provide for the increased demands made upon it. A substation will be erected near West Hill, about half way between Carlisle and Newville, where electricity will be transmittd at 33,000 volts.

JERMYN, PA.—The Scranton Electric Company, of Scranton, Pa., is reported to have purchased the electric plant of the Household Electric Light, Heat & Power Company, which was a co-operative company and was owned by the citizens of Jermyn and Mayfield. It is expected that the plant will be dismantled and electrical service supplied in Jermyn from the central power plant of the Scranton Electric Company in Scranton, which supplies many of the valley towns with electricity.

JOHNSTOWN, PA.—The Johnstown & Altoona Railway Company is reported to be contemplating the construction of a new power house, contracts for which, it is said, will be let in the near future. The company, it is said, will call for bids on the construction of its proposed electric railway from South Fork to Altoona, a distance of 48 miles. G. W. G. Holman is general manager.

MONTOURSVILLE, PA.—The Montoursville Electric Light Company is installing a motor generator set in its plant. It is expected to have the improvements completed by Sept. 1, when a 24-hour service will be established. J. Harry Spencer is general manager.

NEW CASTLE, PA.—The police committee of the City Council has recommended to the City Council that instructions be given to City Solicitor Gardner to draw up an ordinance authorizing the Council to proceed with the preliminary work for establishing a municipal electric light plant. The present contract for street lighting with the New Castle Electric Company will expire in December, 1912.

PLEASANT MOUNT, PA.—The Northwestern Pennsylvania Telephone Company has decided to rebuild its telephone line from Pleasant Mount to Poyntelle and to extend the line to Lake Como.

POLK, PA.—Contracts have been awarded for the electric power plant for the new State Home for the Feeble Minded which is being erected at Polk, Pa. The Bruce Macbeth Engine Company is the general contractor for power machinery and the electrical machinery will be supplied by the Allis-Chalmers Company, of Milwaukee, Wis., including two 125-kva, 100-volt, two-phase, 60-cycle generators with separate belted exciters and a complete switchboard.

SCRANTON, PA.—The Scranton Electric Company is reported to be contemplating the construction of a substation on Pike Street, near South Main Street, plans for which are now being prepared.

BRITTON, S. D.—It is reported that the contract for the installation of a lighting plant has been awarded.

WATERTOWN, S. D.—Plans have been prepared by the Dakota Central Telephone Company for extensive improvements to its system in Watertown, which will include the erection of 640 miles of wire.

BYRDSTOWN, TENN.—The Byrdstown Home Telephone Company, recently incorporated, is contemplating the construction of a telephone line 13 miles in length. John Lacy and others are interested in the project.

HENNING, TENN.—The electric light plant of the Henning Electric Light & Ice Company has been completed and is now in operation.

MEMPHIS, TENN.—Application has been made to the City Council for a franchise by the Clarkesdale, Covington & Collierville Interurban Railway to construct about 9½ miles of track in Memphis. The company has completed its railway to Lakeview.

MEMPHIS, TENN.—The Tennessee Traction Company has completed preliminary surveys and is now securing right-of-way for its proposed electric railway from Memphis to Jackson, a distance of 210 miles. The company, it is said, will increase its capital stock from $50,000 to $1,000,000. George E. Busnell, of Memphis, Tenn., is general manager.

BRYAN, TEX.—An electric light plant is being installed in Dellwood Park, midway between Bryan and the college, by O. E. Gammill, who is building the Bryan-College interurban railway.

CARTHAGE, TEX.—Plans are being considered by the Lacy Telephone Company for rebuilding the entire plant, including the installation of a new switchboard and replacing overhead wires with cables. J. C. Lacy is president of the company.

CLEBURNE, TEX.—The Cleburne Gas & Electric Company is reported to be contemplating increasing the output of its plant by the installation of 300-kw units. The company, it is said, is making preparations to supply electricity for the street railway system.

WHITESBORO, TEX.—The Monarch Mill & Grain Company is reported to be in the market for equipment for an electric light plant with sufficient output to supply from 160 to 200 lamps.

LAYTON, UTAH.—The Layton Milling & Electric Company has recently placed orders with the Allis-Chalmers Company, of Milwaukee, Wis., for one 50-hp and two 10-hp, 220-volt, three-phase, 60-cycle, squirrel cage induction motors, which will be used for driving additional machinery, which is now being installed in the mill.

PROCTOR, VT.—Work has commenced on the construction of a 35-mile, 44,000-volt transmission line by the Vermont Marble Company, which is to extend from Weybridge, Vt., to West Rutland, for which contracts for material have been awarded. A generating station will be erected at Weybridge, which will be equipped with two 800-kw generating units. Besides the generating station and the tie-in station at West Rutland, two intermediate substations will be erected. The company already has a 2250-kw hydroelectric power plant at Proctor and a 500-kw steam plant at West Rutland, and arrangements are being made for paralleling all three plants on the 10,000-volt line. G. H. Davis, of Proctor, Vt., superintendent of the Vermont Marble Company, has charge of the developments, assisted by C. T. Maynard, electrical engineer of the company.

BEDFORD CITY, VA.—Contracts for the construction of the proposed municipal hydroelectric power plant have been awarded as follows: Concrete work, power house and race to James R. Guy, of Bedford City, Va., for $13,680; for electrical equipment to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for $19,898; electric transmission line complete to S. L. Divers, of Grottoes, Va., for $17,800, and to the S. Morgan Smith Company, of York, Pa., for turbine wheel and all machinery connected with the water power for $11,481. F. Weller, of Washington, is engineer in charge of the work.

RICHMOND, VA.—The Virginia Railway & Power Company is reported to have commenced work on the addition to its power plant, which will increase the output by 500 kw. The cost of the work is estimated at about $200,000.

ROANOKE, VA.—It is reported that Stafford G. Whittle and others, of Martinsville, Va., are interested in a project to establish a town site at the junction of Danville & Western and Winston-Salem divisions of the Norfolk & Western Railway, the town to be known as Kolers. It is proposed to construct a dam across the Smith River and develop 450 hp.

COLVILLE, WASH.—The Interstate Telephone Company, of Spokane, Wash., has filed for record a mortgage to secure an issue of $500,000 in bonds, the proceeds to be used for improvements and extensions to its system.

GRANDVIEW, WASH.—The Benton Independent Telephone Company, of Prosser, Wash., has secured a 25-year franchise in Grandview, Wash., to operate a telephone system.

WHITE SALMON, WASH.—The Mount Adams Railway Company is reported to have awarded a contract for surveying its proposed 40-mile electric railway, which is to connect White Salmon and Glenwood and intervening towns, to the Northwest Engineering & Construction Company. Theodore F. Shepler is general manager of the railway company.

ROMNEY, W. VA.—Application has been made to the county court of Hampshire County by Ira V. Cougill and R. P. Monroe for a 50-year franchise to construct and operate an electric railway between Romney, W. Va., and Winchester, Va.

COLUMBUS, WIS.—Messrs. Vaughn & Meyer, of Milwaukee, Wis., consulting engineers, are reported to have been engaged by the City of Columbus, Wis., to prepare plans for remodeling and improving the service of the municipal electric light plant.

MADISON, WIS.—Sealed proposals will be received at the Forest Products Laboratory, Madison, Wis., until Aug. 12 for furnishing and

installing on Forest Service foundations electrical equipment for driving a 500-hp ground wood pulp grinder in the Forest Service Ground Wood Laboratory. Plans and specifications will be furnished on application to the Forest Products Laboratory.

MADISON, WIS.—The State Board of Control of Wisconsin has retained Frank P. Woy, of Madison, Wis., as power plant expert. Mr. Woy will have general supervision of the ten power plants at the different State institutions, which include steam and producer gas plants, commercial gas, electric, water and steam heating plants and electric drive in the box, hosiery, twine and other factories operated by the inmates of the several institutions. This office has been created with a view to economy of operation and consistent improvement throughout the plants and systems.

MANITOWOC, WIS.—The Electric Light Company, of Manitowoc, Wis., has recently purchased an Allis-Chalmers 100-kw, alternating-current generator to provide for the increased lighting load resulting from the extension of the street lighting system.

MILWAUKEE, WIS.—The Wisconsin Railroad Commission has granted the application of the Milwaukee & Fox River Valley Railway Company for a certificate of convenience and necessity for the construction of a street and interurban railway to extend from Milwaukee to Menesha and intervening cities. The company proposes to supply both freight and passenger service.

SUN PRAIRIE, WIS.—At an election to be held Aug. 9 the proposition to issue $12,500 in bonds, the proceeds to be used for the purchase of the local electric light plant, will be submitted to a vote.

CHEYENNE, WYO.—The Northern Colorado Power Company is reported to have appropriated $50,000 for improvements to its plant and service in Cheyenne. Among the improvements contemplated by the company is the power service for irrigation pumps.

WHEATLAND, WYO.—The contract for the construction of the electric light plant, water works and sewerage systems was awarded to P. O'Brien, of Denver, Col., for a total of $68,720.

CAMROSE, ALTA., CAN.—The citizens on July 20 voted in favor of the by-law appropriating $30,000 for the installation of an electric light plant in Camrose.

EDMONTON, ALTA., CAN.—Plans have been submitted by City Engineer Latournel for the east end extensions of the street railway system. It is understood that bids will be called for immediately.

BRACEBRIDGE, ONT., CAN.—The towns of Bracebridge and Huntsville, Ont., have sent representatives to confer with Hon. Frank Cochrane, Minister of Lands, Forests and Mines, in reference to the High Falls water power. The Town of Bracebridge has a lease to High Falls water power with development privileges, but, according to the municipality of Huntsville, has neglected to utilize its privilege, and the Town of Huntsville is anxious to obtain the right to develop the power. The government has promised to look into the matter.

BROCKVILLE, ONT., CAN.—It is reported that the Brockville Light & Power Department has rejected the bids for the construction of the new power house adjoining the pumping station for the purpose of combining the two plants, owing to the bids being too high, and will do the work by day labor.

LONDON, ONT., CAN.—The time for opening tenders for electrical pumping equipment at the Springbank pumping station, London, Ont., Can., has been postponed from July 29 to Aug. 8. H. J. Glaubitz, of Toronto, Ont., Can., is consulting engineer.

OTTAWA, ONT., CAN.—The Ottawa Electric Light, Heat & Power Company has been granted a permit to construct a substation on Slater Street, Ottawa, at a cost of $18,000.

STRATFORD, ONT., CAN.—The municipality of Stratford is reported to have placed an order with the John Forman Company, of Montreal, Que., Can., for 800 75-watt tungsten street lamps.

SHERBROOKE, QUE., CAN.—The Sherbrooke Street Railway Company has awarded the contract for the construction of its power house in Sherbrooke to the Bishop Construction Company, of Montreal, Que. The Jenckes Machine Company, Ltd., of Sherbrooke, has the contract for furnishing hydraulic machinery and the Canadian General Electric Company for electrical equipment. About 2500 hp will be developed. Ross & Holgate, of Montreal, Que., are consulting engineers.

ESTEVAN, SASK., CAN.—Tenders will be received by L. A. Duncan, secretary and treasurer, Estevan, Sask., until Aug. 24 as follows: Contract A—Pipe laying on storm sewers. Contract B—Construction of power house. Contract H—Two return tubular boilers. Contract J—High-speed steam engine. Contract K—Electric lighting system. Contract S—Sewer pipes. Plans and specifications may be seen at the office of Chipman & Power, engineers, Winnipeg, Man., Can., and Toronto, Ont., Can.

MOOSE JAW, SASK., CAN.—A franchise has been granted to A. A. Dixon and Newton J. Kerr to construct and operate a railway in Moose Jaw, 6 miles in length. John B. McRae, of Ottawa, Ont., and H. A. Dixon will have charge of construction.

TOLUCA, MEX.—The Sultepec Electric Light & Power Company, of Toluca, Mex., is preparing to install one 800-kw, 2200-volt, three-phase, 60-cycle generator and a 1200-hp turbine at its Temascaltepec station. R. J. M. Danley is manager of the company.

## *New Industrial Companies.*

A. O. SCHOONMAKER COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $100,000 for the purpose of manufacturing and dealing in electrical and insulating compositions. The incorporators are: A. O. Schoonmaker, of New York, N. Y.; F. W. Webster, of Newton, Mass., and W. V. Brown, of Asheville, N. C.

THE ARGO ELECTRIC VEHICLE COMPANY, of Saginaw, Mich., has been incorporated with a capital stock of $200,000 by Theodore Huss, Fred Buck, Benton Hanchett and Otto Schupp, of Saginaw, Mich., and A. M. Marshall, of Duluth, Minn. The company proposes to manufacture electric pleasure vehicles.

THE AUTOMATIC FEED REGULATOR & SPECIALTY COMPANY, of Kittery, Maine, has been incorporated with a capital stock of $200,000 to manufacture and deal in apparatus relating to steam, gas, etc.

THE C. J. ANDERSON COMPANY, of Chicago, Ill., has been chartered by Carl J. Anderson, Andrew Anderson and Gustaf R. Anderson for the purpose of manufacturing and dealing in electrical appliances.

THE ECLIPSE ELECTRICAL MANUFACTURING COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $15,000 for the purpose of manufacturing electrical appliances. The incorporators are: William E. Bodenstab, John Renner and Frederick Kirchhoff.

THE ETHYLIGHT COMPANY, of New York, N. Y., has been chartered with a capital stock of $350,000 by R. E. Taylor, R. C. Shaal and J. V. Usera, of New York, N. Y. The company proposes to manufacture automobile lamps and lighting devices, etc.

THE GARRETSON ENGINEERING COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $100,000 by Albert D. Garretson, Harry D. Garretson and William M. Hoffman, all of Buffalo, N. Y. The company proposes to manufacture engines, boilers, dynamos, etc. This item was published in the issue of July 14, naming H. O. Garretson instead of Harry D. Garretson as one of the incorporators.

THE GRANDJEAN GAS ENGINE COMPANY, of San Diego, Cal., has been incorporated with a capital stock of $1,000,000 for the purpose of manufacturing gas engines under a patent held by Arthur Grandjean. The incorporators are: G. R. Harrison, G. H. Ellerman, R. A. Wood and W. R. Gros.

THE HALLSTONE ELECTRIC COMPANY, of Brockton, Mass., has been incorporated with a capital stock of $10,000 to do a general electrical business. The officers of the company are: Bertrand L. George, president; George N. Hall, vice-president, and Arnold R. Stone, treasurer and clerk.

THE ILLINOIS ELECTRIC PORCELAIN COMPANY, of Macomb, Ill., has been incorporated with a capital stock of $20,000 to manufacture and deal in electric porcelain and in materials for making pottery. The incorporators are: Charles W. Kettron, C. M. Erwin and W. C. Sutton.

THE IN-ER GLOBE LAMP COMPANY, of Boston, Mass., has been chartered with a capital stock of $125,000 for the purpose of dealing in electrical supplies. The officers of the company are: William Hyde, of Boston, Mass.; Samuel Washburn, treasurer, and George H. Wells, clerk, both of Dorchester, Mass.

THE M. S. PALMER COMPANY, of Boston, Mass., has filed articles of incorporation with a capital stock of $15,000 and proposes to deal in electric and gas fixtures. The incorporators are: Charles H. Glidden, of Cambridge, **Mass., president; Marcus S. Palmer**, of Malden, Mass., treasurer; Herbert G. Hatch, clerk, and E. Saugus, 185 Summer Street, Boston, Mass.

THE PORT JACKSON ENGINEERING & MANUFACTURING COMPANY, of Amsterdam, N. Y., has been incorporated by R. G. Daye, E. Jackson, of Amsterdam, N. Y., and C. H. Williams, of Rotterdam, N. Y. The company is capitalized at $25,000 and proposes to do a general engineering and manufacturing business.

THE PREMIER ENGINEERING & MANUFACTURING COMPANY has filed articles of incorporation with the Secretary of State at Trenton, N. J., with a capital stock of $100,000, by E. J. Forhan, G. F. Martin and H. P. Jones, of New York, N. Y.

THE REMY ELECTRIC COMPANY, an Indiana corporation, has filed articles of incorporation in Chicago, Ill. The company is capitalized at $1,000,000 and deals in electrical supplies. Fred J. Urhan, 1400 Michigan Avenue, is the Chicago representative.

THE ROCHESTER TROLLEY GUARD & FENDER COMPANY, of Rochester, N. Y., has been incorporated by W. F. Reichenbach, A. A. Piehler and C. W. Henning, of Rochester, N. Y. The company is capitalized at $50,000 and proposes to manufacture appliances for trolley cars, etc.

THE ROYAL ELECTRIC COMPANY, of Camden, N. J., has been incorporated by E. L. Jackson, J. P. Murray and F. A. Kuntz, of Camden, N. J. The company is capitalized at $50,000, and proposes to do a general electrical contracting and mechanical engineering business.

THE SANITARY ENGINEERING & CONTRACTING COMPANY, of Newark, N. J., has filed articles of incorporation with a capital stock of $100,000 for the purpose of erecting plants for the disposal of waste, refuse, garbage, etc. The incorporators are: P. M. Lynch, F. C. Fowler, A. Guttman, of New York, N. Y., and A. Henig, of Newark, N. J.

THE SCHEU-DEXTER MANUFACTURING COMPANY, of New York, N. Y., has been chartered with a capital stock of $1,000,000 by W. C. Sheu, of Springfield, Mass.; S. D. Webb, of New York, N. Y., and H. D. Dumont, of Brooklyn, N. Y. The company proposes to manufacture and deal in gas and electrical supplies and appliances.

THE STAR ELECTRIC COMPANY, of Binghamton, N. Y., has been incorporated with a capital stock of $300,000 to manufacture electric supplies and appliances by George O. Knapp, of 54 Wall Street, New York, N. Y.; Giles W. Mead, Edgar F. Price, both of 79 Wall Street, New York, N. Y., and others.

THE STEVENS MANUFACTURING COMPANY, of Rome, N. Y., has been incorporated by S. B. Stevens, A. L. McAdam, of Rome, N. Y., and T. J. Wetzel, of New York, N. Y. The company is capitalized at $50,000 and proposes to manufacture and sell carbureters, motor and automobile supplies, etc.

## New Incorporations.

SULPHUR SPRINGS, ARK.—Articles of incorporation have been filed for the Sulphur Springs Telephone Company with a capital stock of $25,000 by Clyde W. Penwell, Le Roy Penwell and Louis Kenworthy.

LAMAR, COL.—The Sylvan Lake Power Company has been organized by. H. M. Hogg and associates to develop water power on Fall Creek in San Juan County. The company is capitalized at $500,000.

ORFINO, IDAHO.—Articles of incorporation have been filed for the Clearwater Telephone & Telegraph Company with a capital stock of $40,000 by Samson Snyder, A. O. Anderson and Frank A. Jones.

SALINE, ILL.—The Saline County Light & Water Company has been granted a charter with a capital stock of $5,000 to construct, acquire and operate water works, ice, steam or electric plants. The incorporators are: A. C. Murray, W. L. Murphy and W. M. Timmons.

FARMINGTON, IND.—The Farmington & Chestnut Ridge Telephone Company has been incorporated with a capital stock of $8,000 by William Booth, A. A. Ruddick and B. F. McIntire.

HUNTINGBURG, IND.—Articles of incorporation have been filed for the Huntingburg Electric Light Company with the Secretary of State with a capital stock of $25,000 by Charles Miessner, F. G. Katterhenry and August Miessner. The company proposes to construct and operate an electric plant in Huntingbury.

LIMA, IND.—The Star Milling & Electric Company has been chartered with a capital stock of $10,000 by Oliver P. McKee, Harriet McKee and Emanuel Ritzer. The company proposes to generate electricity foi transmission.

WASIOTO, KY.—The Cumberland River Telephone & Telegraph Company has been formed by B. N. Worthington and others. The company is capitalized at $25,000 and proposes to construct a local telephone system and long-distance lines in Cumberland Valley.

CANTON, MAINE.—The Canton Light & Water Company has been organized for the purpose of furnishing electricity in this locality. The company has purchased the water power at East Peru, where 110 hp will be developed. The plant will be located about six miles from Canton. It is said that work will commence on construction of the plant immediately. D. D. Elliot is manager.

AUGUSTA, MICH.—Articles of incorporation have been filed for the Augusta Telephone Company with a capital stock of $6,000 by Nelson V. Bird, Charles Case, H. J. Richardson, H. V. Case, D. J. Bailey and others.

FAIRVIEW, OKLA.—The Fairview & Oklahoma City Railway Company has been granted a charter with a capital stock of $100,000 to construct and operate an electric railway from Fairview to Rusk, a distance of 4½ miles. The officers of the company are: O. E. Snyder, of Oklahoma City, Okla., president; H. A. Noah, of Alva, Okla., secretary, and M. M. Fulkerson, of Alva, Okla., treasurer.

## Legal.

NELSONVILLE, OHIO.—In an opinion rendered to C. W. Juniper, city solicitor, of Nelsonville, Ohio, Attorney-General Denman states that municipalities are permitted under the laws of the State to purchase energy to be resold, as well as to generate it with their own plants to be retailed for lamps, heat and power purposes.This right was given when the General Assembly amended an old law relating to the matter some years ago.

## Personal.

*MR. W. H. BROWN* has resigned his position with the Peoria Gas & Electric Company to assume charge of the Grand Forks (N. D.) Gas & Electric Company.

*MR. CHARLES TABER WALKER,* manager of the Cleveland office of the *Electrical World,* was married July 16 to Mrs. Elizabeth Johnstone Bates, at Cleveland.

*MR. CLAYTON E. INGALLS,* San Francisco, has been appointed manager of the small motor department of the Los Angeles office of the General Electric Company.

*MR. T. EVANS,* for many years purchasing agent for the Cananea Copper Company, has been appointed local manager of the Mine & Smelter Supply Company's branch office at Denver.

*MR. M. S. SEELMAN, JR.,* of the Edison Electric Illuminating Company of Brooklyn, has been appointed editor of the "Question Box" of the National Electric Light Association, to succeed Mr. John C. Parker.

*MR. S. N. CLARKSON,* of the general engineering department of the Westinghouse Electric & Manufacturing Company, has accepted a position in the new business department of the Union Electric Light & Power Company, St. Louis.

*MR. GEORGE VERITY,* of the electrical firm of Verity's, Limited, Birmingham, England, and Mr. E. W. Arnold, an associate member of the (British) Institution of Electrical Engineers, are visiting points of electrical interest throughout America.

*MR. E. L. PEARSALL,* manager of the commercial department of the Altoona Gas Company, has been transferred to a similar position with the Union Gas & Electric Company, Bloomington, Ill. Both companies are subsidiary to the Susquehanna Railway, Light & Power Company.

*MESSRS. SAMUEL INSULL, THOMAS E. MITTEN, MASON B. STARRING AND B. E. SUNNY* are included in a delegation of 59 citizens of Chicago appointed by Mayor Busse to represent the city at the International Prison Congress, which will be held in Washington, D. C., in October.

*MR. C. A. TUPPER,* recently in charge of the publicity work of the Allis-Chalmers Company, is now manager of the Reliance Engineering & Equipment Company, 1417 Majestic Building, Milwaukee. This company is engaged in general engineering work and the sale of electrical and other machinery.

*DR. AUGUST RAPS,* who recently received the degree of doctor of engineering from the Dantzig Technical High School, is a director of Siemens & Halske and general manager of the Werner factory of Siemens & Halske and Siemens-Schuckertwerke, but is not a member of the technical staffs of these firms.

*MR. CHARLES F. SCOTT* represented Mr. George Westinghouse at the joint meeting of the American Society of Mechanical Engineers and the Institute of Mechanical Engineers in London. He was scheduled to deliver Mr. Westinghouse's paper, "The Electrification of Railways," on July 29, and while abroad will represent Mr. Westinghouse in other matters.

*MR. JOHN W. LIEB, JR.,* associate general manager of the New York Edison Company, returned from Europe, July 25, on the North German Lloyd steamship *Prinz Friedrich Wilhelm.* Mr. Lieb left New York over two months ago in search of needed rest. His health has very much improved in the interim and he returns to his arduous labors reinvigorated and refreshed.

*MR. EDWARD J. DOYLE,* secretary to President Samuel Insull, of the Commonwealth Edison Company, was married on June 27 to Miss Bertha Katherine Streff, daughter of Mr. and Mrs. E. A. Streff, of 5246 Kenmore Avenue, Chicago. Mr. Doyle's unfailing courtesy and tact has made him many friends, both inside the company and out of it, and they all unite in extending heartiest congratulations.

*MR. H. A. STRAUSS,* vice-president and chief engineer of the Falkanau Electrical Construction Company, of Chicago, has been appointed consulting engineer by the Davis and Weber Counties Canal Company, of Utah, to undertake the design of the 15,000-hp hydroelectric development of the Davis and Weber counties canal. Mr. Strauss is identified with several other Utah electrical engineering properties, among which are the Salt Lake & Ogden Railway, the Utah & Salt Lake Southern Railroad and the Salt Lake & Los Angeles, the last named being a steam railroad which will soon be electrically equipped.

*MR. FRANK P. WOY,* consulting engineer, of Madison, Wis., has been retained by the State Board of Control of Wisconsin as power plant expert, with general supervision of the operation of the 10 power plants at the different State institutions. These plants range up to 1000-hp capacity, and include steam and producer gas plants, commercial gas, electric, water and steam-heating plants and electric drive in the box, hosiery, twine and other factories operated by the inmates of the several institutions. Economy of operation and consistent improvement throughout the plants and systems are the objects of the State in creating this office.

*MR. JOHN C. RENNARD,* formerly assistant chief engineer of the New York Telephone Company, has been appointed electrical engineer of the New York City Fire Department, to supervise the construction of a fire alarm telegraph system for the beginning of which the Board of Estimate has appropriated $420,000. Mr. Rennard graduated from the United States Military Academy at West Point in 1890, and remained there for two years as junior instructor. He then pursued post-graduate studies at Columbia University and received the degree of E.E. from that institution in 1894. Mr. Rennard is a member of the Automobile Club of America and the Riders' and Driver' Club, and is an associate of the American Institute of Electrical Engineers.

*MR. PHILANDER BETTS* has been appointed chief engineer of the Board of Public Utility Commissioners of New Jersey. Mr. Betts has been practising as consulting engineer and expert in Washington for several years, and is also assistant professor of electrical engineering at George Washington University. He graduated in 1891 from the electrical

course of Rutgers College, New Brunswick, and later entered the employ of the Field Engineering Company, New York, for whom he superintended the electrical equipment of roads in Newark and Philadelphia. In June, 1893, he became associated with the Westinghouse Electric & Manufacturing Company, for which he equipped railway power stations at Hazleton, Pa.; Gloucester, N. J., and other cities. While on this work he carried on many tests on power consumption, the effect of grades, curves, etc., which he embodied in a thesis for which Rutgers College gave him the degree of Master of Science in 1895. While in Washington he has been engaged as expert principally in electric lighting and electric power distribution problems, a large part of it being for the Washington Railway & Electric Company, for whom he has also done expert work in electric traction. He is a member of the A. I. E. E. and chairman of its Washington section. He is also a member of the Illuminating Engineering Society and of the Society for Promoting Engineering Education.

## Trade Publications.

SINGLE-PHASE COMMUTATOR MOTORS for stationary applications are described in a bulletin of the Lincoln Electric Company, Cleveland, Ohio.

METAL CONDUIT.—The National Metal Molding Company, Pittsburgh, Pa., is distributing mailing folders dealing with "Sheraduct" rust-proof, non-corrosive conduit.

CONCRETE RAILWAY TIES.—The use of reinforced concrete for railway ties is discussed in detail in an illustrated catalogue issued by Kneedler, Couch & Hanson, Sioux City, Iowa.

WIRE.—Price-lists and much useful data pertaining to bare and insulated wires for electrical purposes are contained in a neatly-executed publication issued by the Rome Wire Company, Rome, N. Y.

ELECTRIC MOTOR FANS.—The Sprague Electric Company, 527 West 34th Street, New York, has issued booklet No. 322-A in which are listed and described desk, wall, ceiling and ventilating fans driven by alternating-current motors.

MOTOR DRIVES FOR PRINTING MACHINERY.—Much valuable information concerning the proper application of electric motors for driving various types of print-shop machinery is contained in Bulletin No. 381 of the Triumph Electric Company, Cincinnati, Ohio.

LIGHTNING ARRESTERS.—In Bulletin No. 4736, entitled "Lightning Arresters," issued by the General Electric Company, are described and illustrated in considerable detail various types of arresters for alternating-current and direct-current, high-voltage and low-voltage circuits.

ELECTRIC LIGHTING FIXTURES.—A 54-page publication issued by the F. W. Wakefield Brass Company, Vermilion, Ohio, as catalogue No. 2, deals with various types of lighting fixtures for ceiling and side wall mounting. Special attention has been given to the requirements of metallic-filament lamps.

ELECTRIC VEHICLES.—The Babcock Electric Carriage Company, 226 West Utica Street, Buffalo, N. Y., is distributing two mailing novelties designed to attract attention to its electric vehicles. A mailing folder with return card attached gives much data relating to the cost of owning and operating an electric car, while an illustrated booklet of envelope size gives many valuable "dont's" for the user of electric vehicles.

INSTRUMENTS OF PRECISION.—This is the fifth edition of the general catalogue of instruments of precision built by E. Ducretet, 75 Rue Claude-Bernard, Paris, France. It embraces apparatus covering general physics, heat, acoustics, optics, mechanics, topography and cocmography and gives brief descriptions and prices of the myriad instruments and parts listed. The catalogue contains 323 pages and an excellent index.

CORLISS ENGINES.—The Providence Engineering Works, of Providence, R. I., builders of Rice & Sargent Corliss engines, have issued Bulletin S-75 illustrating the standard, heavy-duty type of Corliss engines built by the works and giving details of construction and pertinent data regarding floor space, horse-power ratings, etc. The bulletin is well prepared and is replete with information on every part of the engine, which is among the best known built in this country.

ELECTRIC COOKING APPARATUS.—Publication No. 3968, issued by the General Electric Company, on the subject of electric cooking apparatus for hotels and restaurants, should be of considerable interest to managers of hotels and restaurants. The publication referred to illustrates and describes various appliances designed especially for hotels and restaurant use, for example, broilers, roasting and baking ovens, toasters, plate warmers, stock kettles, automatic egg boilers, etc.

GRAPHITE.—With the compliments of the International Acheson Graphite Company, there is being distributed a handsome book of 143 pages, printed on heavy deckle-edged paper, with gilt top, and bound in limp leather, bearing the title: "A Pathfinder—Discovery, Invention and Industry. How the World Came to Have Aquadag and Oildag; also Carborundum, Artificial Graphite and Other Valuable Products of the Electric Furnace." As may be judged by this title, the volume is a history of the life and achievements of Dr. Edward G. Acheson, consisting mainly of Dr. Acheson's own story of his career. The book contains a steel engraved portrait, and is an interesting record of a busy and useful life.

SPECIAL FEED-WATER HEATER—The Harrison Safety Boiler Works, Philadelphia, Pa., in their engineering leaflet No. 7, entitled "Combination Feed-Water Heaters and Softening Systems," describes this apparatus which differs from the company's well-known Sorge-Cochrane hot process system in that provision is made for heating two separate feed-water supplies independently, and for treating only one with a reagent. The condenser discharge or other returns, after passing over heating trays, pass directly to the pump supply chamber or pure water compartment, whereas the raw water, after heating and mixing with the reagent, falls into a spacious sedimentation chamber and afterward passes through a filter bed before entering the pure water compartment. To insure a continuous supply of water to the boilers in case of clogging of the filters, there is an automatic by-pass which, in case the level of the water in the pump supply chamber should fall below a certain level, will supplement with sufficient hot, treated water to supply the pumps. In a hot process system, the "temporary" hardness, or carbonates, are precipitated by heat, and the only reagent required is that needed for the transformation of "permanent" hardness, such as sulphates, chlorides, nitrates, acids, etc. Due to the use of only one reagent, the management of the apparatus is much simplified, no complicated chemical analyses being required, as where two reagents must be proportioned to the varying requirements of the water. The apparatus has the further advantage over a cold-process system that it performs, in addition, the functions of the feed-water heater which should be installed in any case. For this purpose it can be adapted to any of the various forms assumed by open feed-water heaters; that is, can be used as heater and receiver in connection with an exhaust steam-heating system, etc.

## BUSINESS NOTES.

SANCHEZ X-RAY APPARATUS.—The sale in this country of the Sanchez x-ray apparatus has been placed by the Spanish inventor with Mr. Edwin A. Robertson, formerly with the Lord Electric Company, whose present address is 90 Morningside Avenue, New York.

RIDGWAY ENGINES.—Of a large number of four-valve engines recently sold by the Ridgway Dynamo & Engine Company, Ridgway, Pa., two (28 in. x 32 in.) were ordered by the Susquehanna Railway, Light & Power Company, of Wilkes-Barre, Pa., and one (12 in. x 16 in.) by the Nittany Light, Heat & Power Company, State College, Pa.

THE AMERICAN LAMP COMPANY has a New England office and warehouse at 184 Franklin Street, Boston, in charge of Mr. A. E. Payne, as New England manager. A large stock of tungsten, tantalum, gem and carbon-filament lamps will be carried, and also a complete line of miniature lamps—carbon, tungsten and tantalum.

THE INTERSTATE SUPPLY COMPANY, of Sioux City, announces the change in its name to the Interstate Electric & Manufacturing Company, and the consolidation with the Interstate Electric Manufacturing Company, of which corporation it was the owner. There has been no change of stockholders, directors or officers, the change being made for the purpose of simplifying accounting, and to get a more appropriate name for both lines of business.

VULCANIZED FIBER.—J. C. Parker & Son Company, of New Castle, Del., is building a plant for the manufacture of vulcanized fiber, having recently purchased for this purpose the Knowles Woolen Mills, situated on the railroad as well as on the river front at New Castle, a modern, well-constructed building. It is now preparing to make contracts for machinery necessary to produce 5000 to 6000 lb. of fiber a day, and expects to be in operation and have stock to sell before Jan. 1.

CHANGES IN THE HOLOPHANE ORGANIZATION.—A number of changes in the personnel of the Holophane Company were announced at the company's recent annual conference, held at the Sagamore, Lake George. Mr. W. F. Minor is appointed assistant general manager; Mr. C. Walter Jones, formerly manager of the New York branch, succeeds Mr. Minor as sales manager; Mr. John W. Foster succeeds Mr. Jones as manager in New York, while H. D. Howe takes charge of the fixture department, which will be located at Newark, Ohio. The 1910 Holophane conference was the most successful in the company's history, 102 persons being present. Of these, 28 were guests, including representatives of the National Electric Light Association, the National Electric Contractors' Association and the Electrical Supply Jobbers' Association.

WESTERN UNION TELEGRAPH COMPANY.—To assist him in supervising the large territory under his direction, Mr. T. P. Cook, general superintendent of the western division of the Western Union Telegraph Company, with headquarters in Chicago, has been given a staff of three division assistants, each of whom will head a newly created department. All will be directly responsible to Mr. Cook. Mr. W. J. Lloyd, who has been superintendent of the first district of the western division, with headquarters in Chicago, has been appointed division superintendent of traffic. Mr. M. T. Cook, who has been general agent, is now division commercial superintendent, and Mr. M. H. Clapp, an engineer and expert in maintenance of line, has been appointed division superintendent of plant. These three men, each a specialist in his respective department, will constitute the executive staff of the general superintendent, and their field of authority will extend over the entire western division. All will have their headquarters in Chicago. Mr. A. B. Cowan, assistant district superintendent, has been promoted to fill the place of Mr. Lloyd. These changes were effective Aug. 1. The western division includes that part of the United States between Buffalo and Cincinnati on the east, the Ohio River on the south, the Missouri River on the west, and the national boundary on the north.

# DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Lloyd Lyon, Mobile, Ala.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, Engineering Societies Building, 29 West 39th St., New York. Next meeting (semi-annual) Chicago, Nov. 14, 15 and 16, 1910.

American Electrochemical Society. Secretary Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, 158 West 176th St., New York City.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July August and September.

American Street & Interurban Railway Accountants' Association. Secretary, H. E. Weeks, Davenport, Ia.

American Street & Interurban Railway Engineering Association. Secretary, John W. Corning, Boston Elevated Railway Company, Boston, Mass.

American Street & Interurban Railway Association. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

Arkansas Association of Public Utility Operators. Secretary, J. E. Cowles, Little Rock, Ark.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 509 Perry-Payne Building, Cleveland, O.

Association of Railway Telegraph Superintendents. Secretary P. W. Drew, 135 Adams St., Chicago. Next meeting Boston, Mass., June, 1911.

Association of Railway Electrical Engineers. Secretary, George B. Colegrove, 960 Monadnock Building, Chicago. Next annual meeting, Chicago, Oct. 4, 5, 6 and 7, 1910.

Association of Edison Illuminating Companies. Secretary, D. L. Huntington, Spokane, Wash.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allen H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association Secretary, A. L. Neereamer, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Acting Secretary, F. D. Morris, 323 Hagerman Bldg., Colorado Springs, Col. Next meeting, Glenwood Springs, Sept. 21, 22 and 23, 1910.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electric Vehicle and Central Station Association. Secretary, H. T. Sands, 139 Pleasant St., Malden, Mass.

Electric Club, Chicago. Secretary, F. S. Hickok, 824 Marquette Building, Chicago. Meets every Wednesday noon, 303 Wabash Ave.

Electric Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Next meeting, Albany, N. Y., Jan. 17, 1911.

Electric Trades Association of Philadelphia. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Contractors' Association of State of Missouri. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next annual meeting, Chicago, Nov. 3, 1910.

Electrical Supply Jobbers' Association.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York. Next meeting, New York City, Oct. 5, 1910.

Engineering Society of Wisconsin. Secretary, W. G. Kirchoffer, 31 Vroman Building, Madison, Wis.

Engine Builders' Association of the United States. Secretary, C. H. Lembower, Reading, Pa.

Florida Electric Light & Power Association. Secretary, H. C. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., April 4 and 5, 1911.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria. Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntington, Ind.

Internal Combustion Engine Association. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Rochester, N. Y., Sept. 6, 7, 8 and 9, 1910.

International Electrotechnical Commission. (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

International Independent Telephone Association. Secretary, A. C. Davis.

Iowa Electrical Association. Secretary, W. N. Keiser, Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

Iowa Independent Telephone Association. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Annual meeting, second Wednesday in March each year.

Iowa Street & Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Kansas City, Kan., Sept. 27 and 28, 1910.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October, each year.

Maine Electrical Association. Secretary, Fred D. Gordon, Auburn, Maine.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. P. Biggs, Detroit, Mich. Next meeting, Port Huron, Mich., Aug. 16, 17 and 18.

Minnesota Electrical Association. Secretary, B. W. Cowperthwait, Faribault, Minn.

Mississippi Electric Association. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss.

Missouri Electric, Gas, Street Railway & Water Association. Secretary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

Missouri Independent Telephone Association. Secretary, G. W. Schweer, Windsor, Mo.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National District Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio.

National Electric Light Association. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

National Electric Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

National Electrical Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn. Next meeting, New York, March, 1911.

National Electrical Credit Association. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

Nebraska Electrical Association. Secretary, Frank McMaster, Beatrice, Neb.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Section, National Electric Light Association. Secretary, C. H. Hodskinson, 89 Lafayette St., Boston, Mass.

New Orleans Electrical Contractors' Association. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

New York State Independent Telephone Association. Secretary, R. M. Eaton, Niagara Falls, N. Y.

Northwest Electric Light & Power Association. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, on board steamer *Queen*, leaving Seattle Aug. 26, 1910.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Columbus, Ohio.

Ohio Society of Mechanical, Electrical & Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Next meeting, Nov. 18 and 19, 1910.

Oklahoma Public Utilities Association. Secretary, Galen Crow, Guthrie, Okla. Next meeting, Oklahoma City, Sept. 30 and Oct. 1, 1910.

Old Time Telegraphers' & Historical Association. Secretary, F. J. Scherrer, 195 Broadway, New York. Next reunion, Chicago, Sept. 8, 9 and 10, 1910.

Order of Rejuvenated Sons of Jove. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal.

PACIFC COAST ELECTRICAL SHOW, San Francisco, Cal., week beginning Aug. 20, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa. Next meeting, Glen Summit Springs, Pa., Sept. 14, 15 and 16, 1910.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

PITTSBURG ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca. N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D. Next meeting, Redfield, S. D., Jan. 11 and 12, 1911.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next biennial meeting, March 1911.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Lena M. Owen, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester Center, Vt.

WASHINGTON ELECTRICAL SHOW, October or November, 1910.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill. Next meeting, Omaha, Neb., October, 1910.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRICAL ASSOCIATION. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association. Secretary, John S. Allen, Lake Geneva, Wis.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 26, 1910.

965,166. ELECTRIC FRICTION-CLUTCH; Leonard Huntress Dyer, Greenwich, Conn. App. filed Sept. 22, 1897. An improved electric friction clutch comprising in combination a trough shaped magnetic member having an energizing coil therein and provided with two tapering pole pieces or rims, and a co-operating armature member having pockets and an overhanging flange substantially as set forth.

965,168.. TRANSFORMER; Melville Eastham, Boston, Mass. App. filed Sept. 3, 1909. A resonant circuit comprising the secondary of a closed core transformer characterized by large magnetic leakage, a condenser in circuit with the said secondary, the secondary having an inductive reactance approximately equal to the capacity reactance of the condenser for the alternation-frequency of the supply current.

965,175. SYSTEM OF MOTOR CONTROL; Ernest L. Gale, Sr., Yonkers, N. Y. App. filed Oct. 9, 1907. In motor-controlling apparatus, the combination with an electric motor, of starting resistance therefor, means for controlling said resistance to effect an acceleration of the motor with normal load, and means permitting the operation of said controlling means for overload.

965,185. TELEGRAPH AND OTHER POLE; John F. Hickman, Tampa, Fla. App. filed Aug. 17, 1909. A pole comprising a base, a lower section secured to the base and formed of two plates inclined each to the other, and an upper section of a tapering shape secured between the ends of the plates opposite the base.

965,187. JUNCTION-BOX, RECEPTACLE, AND PLUG FOR ELECTRICAL CONNECTIONS; William A. Hopkins, Decatur, Ill., New York, N. Y. App. filed Nov. 28, 1908. In a device of the character described, the combination of a junction box body, a lid surmounting said body, a housing cap surmounting said lid, a receptacle mounted on said lid within said housing cap and provided with sockets, and a neck projecting from said housing cap in alignment with the said receptacle and adapted to receive a plug to be inserted into said receptacle.

965,206. INCANDESCENT-LAMP SOCKET; Norman Marshall, Newton, Mass. App. filed Oct. 19, 1908. A key socket provided with means for clamping the socket against a shoulder on a fixture with the key in any predetermined position with relation to the fixture, substantially as described.

965,207. ELECTRIC-CABLE LIGHTNING ROD; Louis L. Mast, West Milton, Ohio. App. filed Nov. 12, 1909. An electric cable for high tension currents, consisting of a multiplicity of straight wires assembled in parallel relation, and a series of bands surrounding said wires, each of said bands having a laterally extended annular rim adapted to lie on the outside of the assembled wires.

965,234. ELECTRIC SWITCH; William M. Scott, Philadelphia, Pa. App. filed Oct. 9, 1909. In an electric switch, the combination with main, fixed and movable contacts, of shunt fixed and movable contacts, a pivotal support for the main movable contact member, a loose pivotal support for the movable shunt contact, an operating member for operating the main movable contact member, and means on the movable shunt contact member engaged by said operating member for shifting said movable shunt contact to wipe said shunt contacts upon each other.

965,258. RECEPTACLE FOR INCANDESCENT ELECTRIC LAMPS; August Weber, Jr., Schenectady, N. Y. App. filed Dec. 13, 1907. In a receptacle for incandescent electric lamps, and in combination, an insulating-base; a screw-shell mounted upon said base; a shell of insulating material formed to receive and rotate around said insulating-base and screw-shell, said shell having an integral portion interiorly screw-threaded to receive and fit said screw-shell.

965,274. ELECTRIC PRESSURE-RATIO INDICATOR; Asa White Kenney Billings, Habana, Cuba. App. filed May 20, 1909. A plurality of receptacles each containing a liquid; pipes leading from the ends of each of said receptacles to different portions of said device through which the said differences of pressures in said different portions are adapted to act on said liquid; and means including a resistance wire partially immersed in a liquid conductor co-acting with said liquid for indicating any variation in the ratio of the differences of pressures in said different portions of said device.

965,275. WALL OR SWITCH BOX; Frederick S. Birtwhistle, Troy, N. H. App. filed April 27, 1909. A wall or switch box having guides movable in relation thereto, attaching lugs carried by and adjustable in relation to said guides, and means for securing the said guides in different adjusted positions.

965,299. RHEOSTAT; Harry Hertzberg and Maurice J. Wohl, New York, N. Y. App. filed May 14, 1907. A rheostat comprising a plurality of heat-absorbing separable metallic masses having exposed corrugated radiating surfaces, an electrical resistance between said metallic masses, keepers extending from one mass into co-operative relation to the other mass, and wedges co-operating with said keepers and with one of the masses for clamping both masses into firm mechanical engagement with said interposed resistance.

965,332. ELECTRIC WATER-HEATER; Frank A. Robinson, Albany, N. Y. App. filed Oct. 27, 1908. An electric water-heater comprising a plurality of independent water conducting pipes, a discharge pipe communicating with a water receiving chamber, and means for opening said discharge pipe simultaneously with the closing of the switch.

965,333. ELECTRIC WATER-HEATER; Frank A. Robinson, Albany, N. Y. App. filed June 7, 1909. An electric water-heater comprising a plurality of water conducting pipes independent of each other, an insulated electric heating conductor extending through said pipes and connected to the binding post carried thereby.

965,368. SUBMARINE-CABLE TELEGRAPHY; Sidney George Brown, London, England. App. filed Sept. 10, 1907. In a system for receiving signals from a cable in cable code the combination with a receiving instrument of means for enabling the discharge currents to be utilized to give amplitude to the signals and a suitably adjusted reaction circuit for modifying such signals to receive increased definition.

965,393. ELECTROCHEMICAL APPARATUS AND PROCESS; Einar Honoratus Meyer and Job Morten August Stillesen, Niagara Falls, Ontario, Canada. App. filed March 20, 1908. A process of making calcium carbid comprising reducing a mixture containing coal and limestone to carbon and lime in a separate chamber by the combustion of a gas containing carbon monoxid in intimate contact with said mixture, feeding the reduced carbon and lime without cooling from said chamber into an electric furnace, and subjecting the same therein to the action of an electric arc.

965,396. AUTOMATIC POTENTIAL-REGULATOR FOR DYNAMOS; John J. Mueller, Jr., Peru, Ill. App. filed May 21, 1909. An automatic potential regulator for dynamos, comprising an electromagnet connected across the main current lines, a core in said electromagnet, a resistance in the field circuit, contact points on the core of said magnet and insulated therefrom, co-operating with said electromagnet for opening and closing a shunt around said resistance, said resistance comprising an electromagnet connected around said points, and pole pieces on said electromagnet adjacent to said contact points.

965,417. TELEGRAPH INSTRUMENT; Frank G. Slemmer, Goldsboro, Md. App. filed May 12, 1909. A telegraph instrument comprising a frame, a line wire binding post on said frame, a key pivoted on the frame and in electrical contact therewith, a contact point supported on the frame and insulated therefrom, a line wire binding post connected to said contact point, a second contact point on the frame and insulated therefrom, a local circuit binding post connected to the second contact point, a third contact point on the key and insulated therefrom, a local circuit binding post connected to the third contact point, the second and third contact points being aligned for engagement, line wires leading from the line wire binding post, local circuit wires leading from the local circuit binding post, a circuit closer actuating mechanism embraced in the local circuit, and a circuit closer connected to the line wires adapted to be operated by said circuit actuating mechanism.

965,449. ELECTRICALLY HEATED APPARATUS; Horace B. Gale, Natick, Mass. App. filed Feb. 28, 1910. In an electrically heated apparatus, the combination with the part to be heated, of a metal receptacle having electric heating means in heat-conductive relation thereto, and provided with a recess in its upper side approximately fitting the said part to be heated, and a heat conducting body fusible at a lower temperature than said part or said receptacle filling the space between them for maintining conditions of maximum heat conduction.

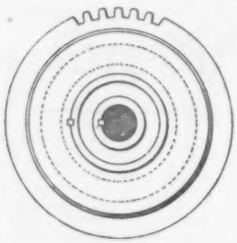
965,534. TIME CIRCUIT-CONTROLLING APPARATUS; August P. Nelson, Chicago, Ill. App. filed Oct. 3, 1908. A circuit controller, a motor mechanism to operate it, a selective mechanism, a clock mechanism and means auxiliary to said selective mechanism and co-operating therewith for retarding the operation of the selective mechanism and for permitting such operation after a predetermined interval of time.

965,543. ELECTRIC MOTOR; Frank L. Sessions, Columbus, Ohio. App. filed Aug. 23, 1906. In a dynamo-electric machine, the combination with an armature and a shaft, of a field frame divided into sections on a plane through the shaft, and a pair of unitary pole pieces secured to the field frame across its plane of separation, said pole pieces being removable with the armature across the plane of separation when the sections of the field frame are apart.

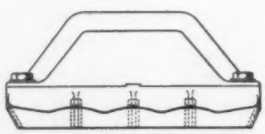
965,609. ELECTRIC PUMP GOVERNOR; Charles W. Townsend, St. Louis, Mo. App. filed June 18, 1906. An electric pump governor comprising a pressure cylinder, piston and rod, a collar fixed on said rod, a coiled spring bearing against said collar, a bell-crank lever having a long arm carrying a contact bar for opening and closing an electric circuit, and a short arm engaging with said fixed collar on the piston rod.

965,639. ELECTRICALLY OPERATED SWITCH; John A. Lundeen, Edgewood Park, Pa. App. filed June 30, 1909. The combination of a valve, a stem, a head carried by said stem, a lever connected with said head, lever being provided with a portion serving as an armature, a pair of magnetic members.

965,649. STARTER FOR ELECTRIC MOTORS; William C. O'Brien and George H. Whittingham, Baltimore, Md. App. filed April 9, 1907. In an automatic starter for electric motors, two regulating solenoids, having their windings in said circuit, one of said solenoids being wound to release its core when the current falls below a certain value, and the other being wound to support its core with less than the said current, a circuit for shunting the coils of the weaker solenoid and a section of the starting resistance and a portion of the windings of the stronger solenoid, a switch in said shunt circuit adapted to be closed by the movement of the core of said weaker solenoid when released from its coils, a circuit for shunting the remaining coils of said stronger solenoid and a section of the starting resistance, a switch in said latter circuit adapted to be closed by the movement of the core of said stronger solenoid when released from its coils, levers engaging the cores of said regulating solenoids, and a holding solenoid having a core adapted to normally bear upon said levers and overbalance the cores of said regulating solenoids, thereby holding the switches normally in open positions.



965,166—Electric Friction Clutch.



965,798—Magnetic Brake Shoe.

965,671. REVERSING SWITCH; George H. Whittingham, Baltimore, Md. App. filed Nov. 2, 1908. In a reversing switch for electric motors, the combination with a motor having shunt field windings. of two contact members connected to one side of the supply circuit. a resistance connected between said contact members, two switch members connected to the armature terminals and normally engaging said contact members, and means for disengaging either of said switch members from said contact members and for connecting it to the opposite side of the supply circuit.

965,672. APPARATUS FOR CONTROLLING ELECTRIC MOTORS; George H. Whittingham, Baltimore, Md. App. filed June 7, 1909. The combination with an electromagnetically operated switch, of a pair of circuits extending therefrom, a push-button in each circuit, serving, when actuated, to open or close said switch, and a master controller, adapted, when in one position, to close the circuit in which one of said buttons is located, and thus render the other of said buttons ineffective.

965,673. CONTROLLER FOR ELECTRIC MOTORS; George H. Whittingham, Baltimore, Md. App. filed June 21, 1909. A motor controlling mechanism comprising a switch member, adjustable at will, a regulating resistance governed thereby, an automatically movable member, a starting resistance governed jointly by said two members, one of said members being adapted to bridge successive portions of the starting resistance.

965,674. CONTROLLING MEANS FOR ELECTRIC MOTORS; George H. Whittingham, Baltimore, Md. App. filed May 21, 1907. In a controlling apparatus for electric motors having shunt field windings, resistances arranged in the armature and field circuits, means controlled by the starting current arranged to cut resistance out of the armature circuit step by step and to automatically insert resistance in the field circuit step by step while the resistance is being cut out of the armature circuit.

965,675. MOTOR STARTER; George H. Whittingham, Baltimore, Md. App. filed Aug. 4, 1908. Renewed Dec. 31, 1909. In an automatic starter, a starting resistance, a series of independently movable rods electrically connected to said resistance, guiding means for said rods permitting the rods to slide longitudinally therein a short-circuiting bar for engaging and moving said rods, an electromagnetic device for moving said bar, and means for retarding the movement of said bar.

965,676. MOTOR CONTROLLER; George H. Whittingham, Baltimore, Md. App. filed April 18, 1910. A controlling mechanism for electric motors, comprising starting and regulating resistances for the armature circuit, and means for automatically maintaining the starting resistance in circuit and the regulating resistance out of circuit while the motor is starting, and for cutting out the starting resistance, and including the regulating resistance after the motor has started.

965,684. CONNECTION AND SEAL FOR THE ENDS OF ELECTRIC CABLES; Fred N. Bierce and Edward T. Jones, Pittsburgh, Pa. App. filed Dec. 8, 1908. A junction box having an opening therethrough, a cable composed of a plurality of separable insulated wires, a metallic casing surrounding said cable, a stuffing box having a recess therein, one member of the stuffing box being secured to the junction box and the other member thereof being secured to the end of the cable casing, an elastic member in the recess of the stuffing box having an orifice for each of the wires of the cable, a rigid disk of insulating material on each end of the elastic member and within the recess in the stuffing box, each of the disks having an orifice in line with each of the orifices in the elastic member for the wires of the cable, and means to secure the members of the stuffing box to each other to compress the elastic member to seal and to secure the end of the cable to the junction box.

965,689. PRESSURE GOVERNOR FOR ELECTRICALLY OPERATED PUMPS; Francis L. Clark, Pittsburgh, Pa. App. filed Feb. 24, 1902. In a pressure governor for air pumps, the combination with a controlling device for the pump and a cylinder and piston for operating the same, of a liquid chamber having a sealed passage communicating with said cylinder, a movable abutment subject to pump pressure for supplying air to said chamber and an exhaust valve rigidly connected to said abutment for releasing air from said chamber.

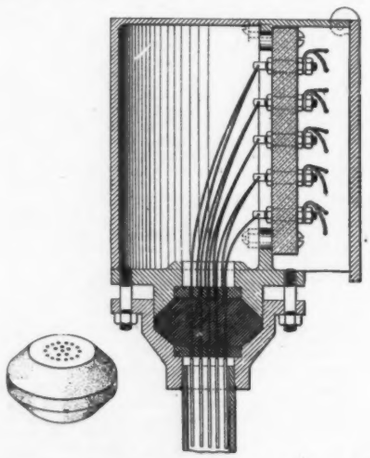
965,710. ELECTRIC-LIGHT FIXTURE; Edwin E. Hayward, Waterbury, Conn. App. filed Jan. 3, 1910. In an electric-light fixture, the combination with a shade holder, of a clamping band of spring metal adapted to extend around a lamp socket and a screw therefor and means extending between and for permanently connecting the clamping band and the shade holder at the upper portion of the latter for the support of the shade holder and which means simultaneously provide freedom for a movement of the shade holder to obtain a concentric and axial relation of said parts.

965,734. PULL SOCKET; Henry T. Paiste, Philadelphia, Pa. App. filed Dec. 22, 1908. The combination in a pull socket of a supporting structure having a transversely extending spindle; a ratchet wheel thereon; a pawl having operating means and placed to act on said wheel; a disk-like structure attached to the ratchet wheel upon the outside face of the supporting structure, and having a projecting contact; with a fixed contact or contacts extending adjacent to said disk-like structure also on the outside face of the supporting structure so as to be alternately engaged by and disengaged from the contact thereof when the pawl is operated.

965,740. TROLLEY DEVICE; William Peterman, Beaver Falls, Pa. App. filed April 12, 1910. In a device of the character described, a trolley wheel, a pair of vertical plates mounted on the axle of said trolley wheel, each of said plates having its upper edge in alignment with the upper edge of the trolley wheel, and having a vertical projection at the top of each plate and a horizontal guard strip at the top of each vertical projection, and spaced above the upper edge of said wheel and located above the trolley wheel.

965,743. ELECTRIC-LAMP SOCKET; Frederick P. Poole, Bridgeport, Conn. App. filed April 15, 1909. An electric lamp key-socket, comprising an insulating body and screw shell and center contact, in combination with wire terminals, a key stem and a switch block mounted on said stem with lost motion, a spring to act on the switch block, a contact carried by the insulating body, and a spring-actuated plate to make connection with said contact, the switch block acting to close the circuit through said contact and to break it with a double break.

965,748. COMBINED TELEPHONE AND TELAUTOGRAPH EXCHANGE SYSTEM; Foster Ritchie, Acton, England. App. filed Oct. 12, 1908. A combined telautograph and telephone exchange system comprising a local battery at each subscriber's station, circuit connections placing these local batteries normally in opposition, and means operative when sending a written message whereby the polarity of the battery of the sender is reversed, substantially as described.



965,684—Connection and Seal for Ends of Electric Cables.

965,793. ELECTRIC SELECTOR AND SIGNALING APPARATUS; William W. Alexander, Kansas City, Mo. App. filed May 27, 1908. In an electric signaling device, a rotary cog wheel, suitable axial supports therefor, a power-actuated propelling pawl adapted to propel said wheel measured distances in the circle of rotation, and vibrating time-controlling devices acting intermittently and alternately with said propelling pawl, to move said wheel in rotation.

965,798. MAGNETIC BRAKE-SHOE; Edgar Harry Cockshott, Leeds, and Alfred Walter Maley, West Bromwich, England. App. filed Aug. 27, 1908. In a track brake electromagnet, an iron core, a pole secured to one end of said core, a second pole surrounding the first secured to the other end of said core and of such width as to contact with the rail of the track at the sides as well as the ends, and a winding adapted to carry current to excite said magnet.

965,810. ELECTRIC CABLE; William Geipel, Southwark, England. App. filed July 24, 1908. An electric cable comprising a conductor and a winding of tape coated with a semi-solid bituminous compound comprising bitumen, solidified petroleum and an insulating liquid.